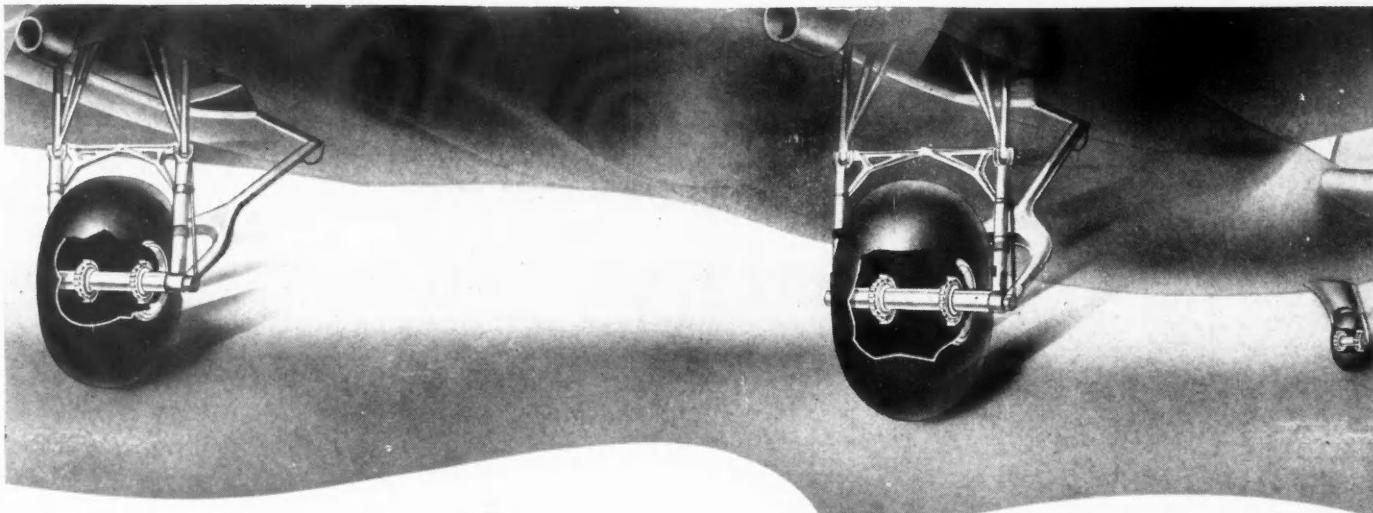


Engineering
Library

JUN 10 1943

AUTOMOTIVE *and Aviation* INDUSTRIES

MAY 15, 1943



A PERFECT

"three pointer"

All Points Timken Bearing Equipped

As horsepower,
weight, speeds—partic-
ularly landing speeds—increase,
the advantages of the high load
capacity of the Timken Bearing
become more pronounced.
Keep this in mind when
designing new and
better planes.

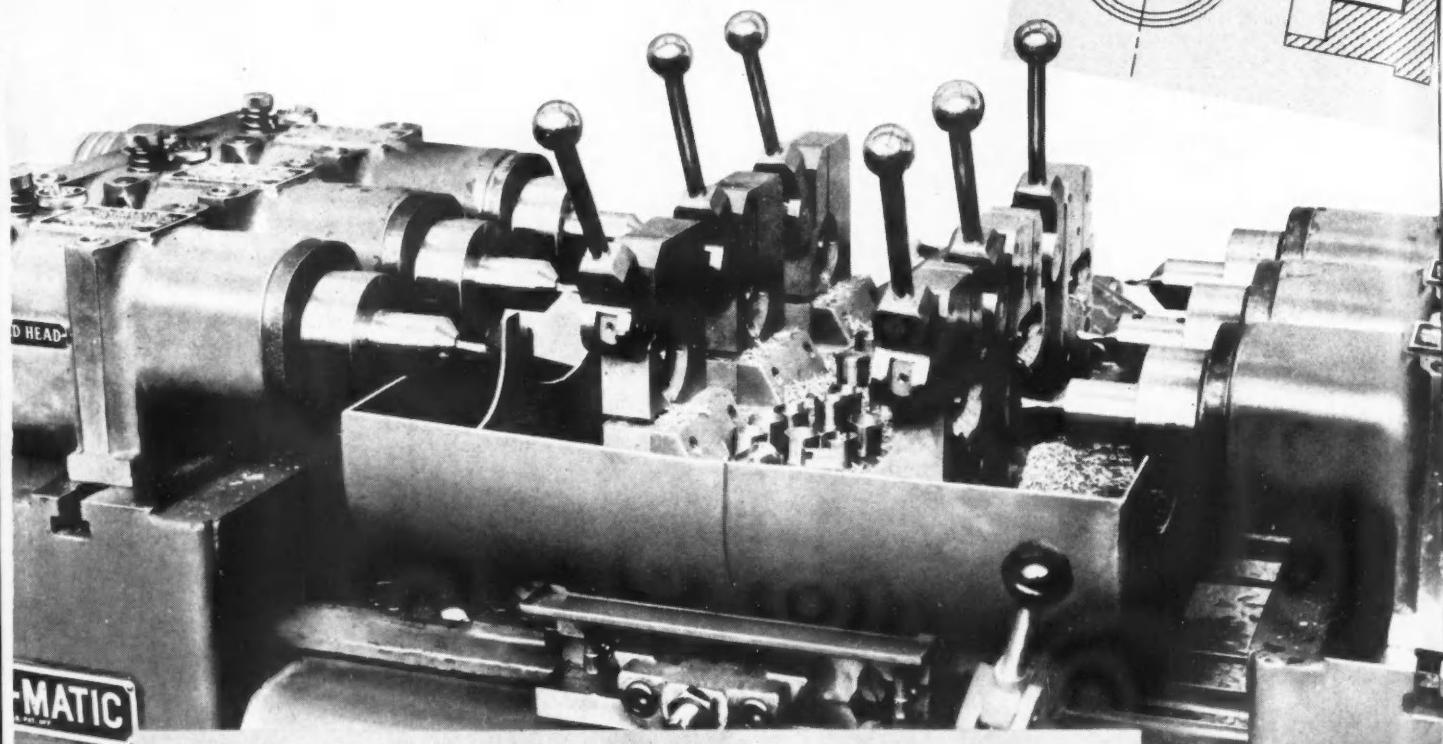
Even before the barnstorming era of aviation Timken Roller Bearings were extensively used in plane landing and tail wheels. Today practically all planes from flivvers to the mightiest bombers are equipped with Timken Bearings in landing and tail wheels and tail wheel swivels—not to mention numerous other applications.

The inherent ability of the tapered roller bearing to carry thrust and radial loads in any combination with the minimum of maintenance attention and without adding unnecessary weight or bulk has always been recognized.

Maximum capacity in the minimum of space has been the forte of the Timken Bearing wherever wheels and shafts turn in whatever industry. In the aviation industry this outstanding characteristic of the Timken Bearing has perhaps more significance, greater importance than in any other. Make sure the wheels you build or buy are Timken Bearing Equipped. The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

JUST 6 SECONDS To Finish a .280" x .690" Slot from the Solid



Heald Bore-Matic plus Heald tooling boosts production to 600 per hour on shell fuse parts

Finishing a slot .280" wide x .690" deep from the solid is ordinarily a comparatively slow process . . . too slow in fact to produce brass shell fuse parts requiring this operation in the huge quantities needed today. Heald field engineers when called in on the job recommended, not a battery of machines, but the single compact Heald Bore-Matic shown above. This Bore-Matic is a No. 49 machine, double-end, with six boring heads carrying end-mills and a six station fixture mounted on a hydraulic cross-slide used for feeding in a side cut. Three fuse parts are slotted simultaneously, three others being loaded meanwhile. Production is 600 per hour, entirely meeting the customers' requirements. Such high production is obtained with a standard Heald Bore-Matic, all units being standard with the exception of tools and fixture. And this job is not an isolated case. Every day Heald Engineering works out equally successful arrangements for getting out more work with more precision. Let's get to work now on your problems in precision boring, turning, facing, chamfering and grooving.

Write, phone, or wire us today.

*More Precision
Faster*

THE HEALD MACHINE CO. WORCESTER, MASS. U. S. A.

MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES

AUTOMOTIVE and Aviation INDUSTRIES

Published Semi-Monthly

May 15, 1943

Number 10

VOL. 88

JULIAN CHASE, Directing Editor
 P. M. HELDIT, Engineering Editor
 J. R. CUSTER, Associate Editor
 JEROME H. FARRIS, Ass't Editor
 MARCUS AINSWORTH, Statistician
 L. W. MOFFETT, Washington News Ed.
 R. RAYMOND KAY, West Coast

JOS. GESCHELIN, Detroit Editor
 E. L. WARNER JR., Associate Editor
 H. H. ROBERTS, Ass't Editor
 HOWARD KOHLBRENNER, Art Editor
 J. DONALD BROWNE, Washington News Ed.
 MARCUS W. BOURDON, British

CONTENTS

The Postwar Small Plane and How to Increase Its Utility. By Peter Altman	17
Improved Band Saws. By H. J. Chamberland	22
Three Versions of the Liberator	24
Droppable Fuel Tanks. By Fred. C. Hoffmann	26
Cold Starting for Diesel Engines (Part Two). By P. M. Heldt	30
New German Warplanes	33
Short Cuts	34
Construction and Equipment of the Focke-Wulf FW 190A-3. By M. W. Bourdon	36
Buick Method for Steel Cartridge Cases	39
New Products for Aircraft	40
New Production Equipment	42
News of the Industry	46
Calendar of Coming Events	50
New Products	67
Advertisers' Index	156-157

Copyright 1943 by Chilton Company (Inc.)

Automotive Division

JOS. S. HILDRETH, President and Manager
 JULIAN CHASE, Vice Pres.

G. C. BUZY, Vice Pres.

OFFICES

Philadelphia—Chestnut & 56th Sts., Phone Sherwood 1424
 New York—100 East 42nd St., Phone Murray Hill 5-8600. Chicago—Room 916 London Guarantor & Accident Bldg., Phone Franklin 4243. Detroit—1015 Stephenson Bldg., Phone Madison 2090. Cleveland—609 Guardian Bldg., Phone Cherry 4188. Washington—1061 National Press Bldg., Phone District 6877. San Francisco—605 Market St., Room 708, Phone Douglas 0967. Los Angeles—6000 Miramonti Blvd., Phone Lafayette 5525.

Cable Address Autoland, Philadelphia

Member of the Audit Bureau of Circulations
 Member Associated Business Papers, Inc.

AUTOMOTIVE and AVIATION INDUSTRIES is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by
CHILTON COMPANY
 (Incorporated)



Executive Offices

Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

Officers and Directors

C. A. MUSSelman, President

Vice-Presidents

JOS. S. HILDRETH GEORGE H. GRIFFITHS
 EVERIT B. TERHUNE J. H. VAN DEVENTER C. S. BAUR
 WILLIAM A. BARBER, Treasurer JOHN BLAIR MOFFETT, Secretary
 JULIAN CHASE THOMAS L. KANE G. C. BUZY
 P. M. FAHRENDORF HARRY V. DUFFY CHARLES J. HEALE

May 15, 1943

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

BEARINGS
IN ENDLESS
VARIETY FOR
DESIGNERS
WHO PLAN

"Perfection"

WAR is the great stimulator—creates the necessity that in turn creates new standards of speed, strength, efficient performance; creates new and better products to meet these standards.

In the forefront of war production, in the forefront of post-war product pioneering is the anti-friction bearing.

In your planning for tomorrow, use Ahlberg's counsel.

Here you'll find a group of competent engineers, with a broad knowledge of industry's requirements and experienced in planning of new products.

Ahlberg also offers a full line of bearings; all types—ball, roller, thrust and mounted units—to meet every anti-friction need.

**A LETTER TO US
 ARRANGES A CONTACT,
 26 BRANCHES TO SERVE YOU**

AHLBERG
 BEARING COMPANY
 * 3002 WEST 47th STREET • CHICAGO, ILL. *

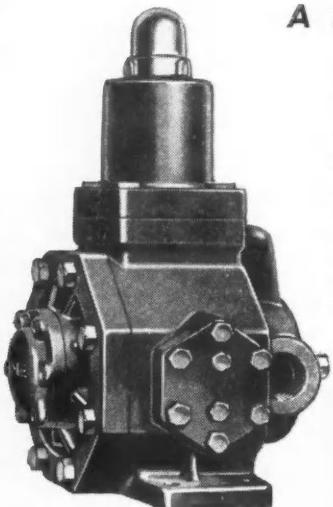
AUTOMOTIVE and AVIATION INDUSTRIES, Vol. 88, No. 10. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, \$1.00 per year. Canadian and Foreign \$2.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15, 1943), 50 cents.

RACINE *Hydraulic*

PUMPS • VALVES and METAL CUTTING MACHINES

RACINE *Variable Volume* HYDRAULIC PUMPS

A Modern Source of Hydraulic Force



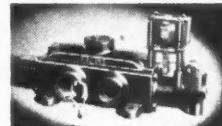
With exclusive "Vane Type Variable Volume" feature for vibrationless performance for holding, bending, molding, forcing, feeding and numerous other operations. Because the flow of oil is automatically varied, Racine Pumps operate at reduced horsepower. They pump only the amount of oil to do the job—no relief valves

required. Varying position of pressure chamber ring reduces hydraulic hammering—avoids momentary shocks and lessens oil heating. Racine Hydraulic Pumps are made in three sizes—0-12, 20 and 30 G.P.M. at 50 to 1000 lbs. pressure per sq. inch. They are available with either manual or electrical control equipment.

RACINE OIL HYDRAULIC VALVES



Racine's exclusive "Sleeve Type" construction keeps balanced piston always in alignment—cannot sag. Unique porting design reduces shock. Sizes $\frac{3}{8}$ " to $1\frac{1}{2}$ " with electrical, mechanical and manual operating devices.

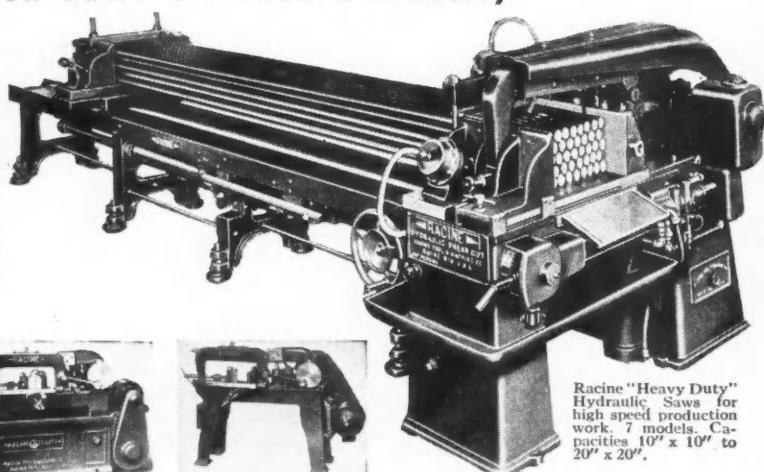


RACINE *Oil Hydraulic* METAL CUTTING MACHINES

The Production Saws of Modern Industry

A complete line for general purpose and high-speed production work. Racine Saws feature "oil-cushioned" Hydraulic Feed and Control. Scientifically designed dual-feed feature makes the cutting of any metal—from soft aluminum tubing to the hardest alloy steels—fast, easy and accurate. Capacities 6" x 6" to 20" x 20".

Also available are Racine Automatic Hydraulic Stock Feed Machines—that bring new labor-saving features and speed-up production.



Racine "Shear Cut" Production Saw. Capacities 6" x 6" and 8" x 9".



Racine "Oil Cut" Hydraulic Saw for high speed, general purpose work. Capacity 6" x 6".



Racine low cost "Utility" Wet Cut Saw, with Hydraulic-Feed and Control. Capacity 6" x 6".



Racine "Utility" Dry Cut Saw. The auxiliary machine for large shops. Capacity 6" x 6".

Racine "Heavy Duty" Hydraulic Saws for high speed production work. 7 models. Capacities 10" x 10" to 20" x 20".

Complete information and prices on any of the above Racine products will be gladly furnished on request. Address Dept. AA-SP.

RACINE TOOL AND MACHINE COMPANY

STANDARD FOR QUALITY AND PRECISION

RACINE, WISCONSIN - U.S.A.





AUTOMOTIVE and AVIATION INDUSTRIES

Volume 88 May 15, 1943 Number 10

AUTOMOTIVE INDUSTRIES

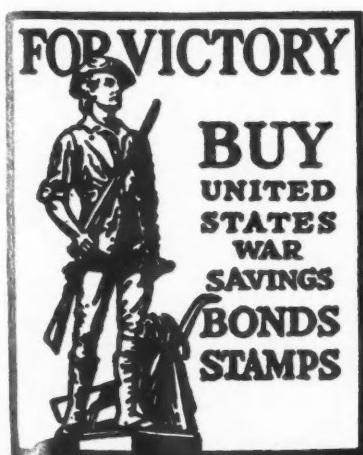
Reg. U. S. Pat. Off.

Cost of Air Mail to P.O. Department Reduced

The 740,000,000 pieces of air mail which will be flown by the airlines of the United States in 1943 will travel an average of approximately 1400 miles, based on the average haul of last year, indicating air mail letter distance is increasing, C. P. Graddick, director of United Air Lines' air cargo department, stated recently.

The cost to the Post Office Department, on a pound-mile basis, is 33.8 per cent less than in 1942 due to a reduction in rate of pay to three-tenths of a mill per pound mile.

The utility of air mail in war-time, Graddick, said, is emphasized by the substantial interchange of correspondence between industrial firms and war production plants, in addition to hundreds of thousands of letters carried monthly to and from Army and Navy bases, domestically and internationally.



The Postwar Small Airplane

17

What will happen to the thousands of pilots that this war has developed? Will it just be latent talent or will it be put to practical use? These are questions that the author of this article goes into with a thoroughness that gives the reader a comprehensive picture of the future of air transportation.

Improved Band Saws

22

Metal cutting band saws have been getting a lot of technical attention during the last few years. As a result they have come into their own in many of the aircraft plants doing a job that has been outstanding in efficiency.

Three Versions of the Liberator

24

We might be prone to think of the Liberator as a fighting machine only. Here are some more peaceful uses that the big bombers can be put to.

Droppable Fuel Tanks

26

Two of these tanks when clamped beneath the wings of a Lockheed Lightning will double its normal range. Owing to its design however, it reduces the top speed only 4 per cent. Here the whole story is told from design to manufacture.

New German Warplanes

33

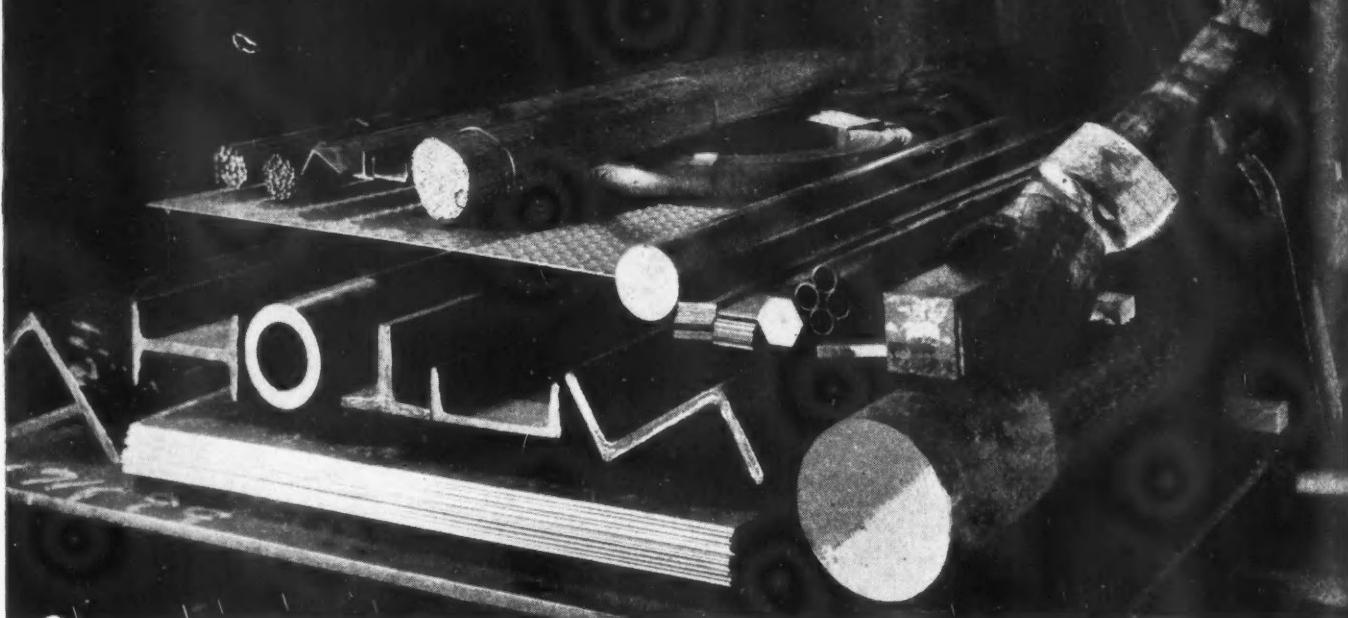
Here are some developments out of the enemy's camp. Data on the dual Benz-Daimler engine and the Messerschmitt Me 323 powered by six 700-800 hp Gnome-Rhone engines are just two of the outstanding subjects treated in this article.

Buick Method for Steel Cartridge Cases

39

At the Buick plant a technique has been developed that is of particular interest to production men. Read this. It goes into details of production as well as the metallurgical requirements.

Call Ryerson First



FOR QUICK ACTION ON STEEL

"WE'RE having better luck on steel, now," said a manufacturer the other day. "There were times when we had to 'phone and 'phone, but now we are going to the warehouse with the most complete stocks, with best facilities for handling and delivery. We are saving the time of shopping around—and saving man-hours in our plant—by calling Ryerson first."

Sound reasoning, isn't it, when you want something, to go where you're most apt to get it. Whether it's fast service, a steady, reliable source, a cutting or fabricating operation that will facilitate your production, or just information and assistance, you're most apt to get what you want by calling Ryerson first!

Ryerson has maintained its leadership in the steel business by making good every promise, by knowing the kind of service customers want and giving it to them, and above all else, by having *in stock* most of the time the kinds, shapes and sizes of steel they want, ready for immediate delivery.

Stocks are reasonably complete, considering the war demand placed upon them. But, whatever kind of steel you want, within the WPB plan; whatever service you would like to have, *call Ryerson first!* You'll get prompt, intelligent cooperation—at Ryerson!

JOSEPH T. RYERSON & SON, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City

RYERSON STEEL-SERVICE

A U T O M O T I V E and AVIATION I N D U S T R I E S

Published on the 1st
and 15th of the month

Vol. 88, No. 10
May 15, 1943

Stinson Voyager, a three-place deluxe airplane powered by a 80-hp engine. Its span is 34 ft, length 22 ft and the gross weight (loaded) is 1625 lb.



and how to increase its utility

By Peter Altman

Engineering Consultant

IN Jan. 1, 1942, there were 100,787 certificated civil pilots and 96,731 students holding flight training permits. This is a total of 197,518 potential civil pilots at the beginning of 1942. This figure does not include military pilots, but it is obvious that with the greatly accelerated pilot training program, that the number of available pilots at the end of the war will easily be double or perhaps triple this number.

What are these pilots going to do with their flying experience when the war is over? Can they afford to buy an airplane, with the low utility which the airplane has at the present time? The obvious answer is "no." Therefore, to take advantage of this vast store of flying experience which will be available, and to put the operation of aircraft on a firm basis, we must increase the UTILITY of the aircraft. Whether it be helicopter or airplane does not matter. But we must take the airplane out of the sportsman class, where it is used only on Saturday and Sunday, and put it into

the field of transportation. This will not only help the aircraft industry, but will have the big advantage of providing the right kind of employment for the thousands of pilots and mechanics who will need work in the postwar period.

The solution to this problem is offered by a plan in which we combine the use of civil airplanes with existing methods of travel. The operation of the plan makes use of a combination of Fly-A-Plane Service with existing or newly organized Rent-A-Car Service.

Fly-A-Plane-Car Service operates in this manner: To make a trip by air, call for an airplane for a given destination and at the same time reserve a car at the destination. If the weather is good, the trip is completed by air and the local calls at the destination are made by car, which is ready when the airplane arrives. Should the weather prevent flying, the trip can be made by car to a point along the route where flying is satisfactory and the remainder of the distance traveled by airplane. Likewise, if the trip is started by air but has to be discontinued along the route, unnecessary layover is not necessary, because the trip can be continued by car to a point where flying can be resumed,

Fig. 1—Civil Airplanes and Certificated Pilots as of January first of Each Year

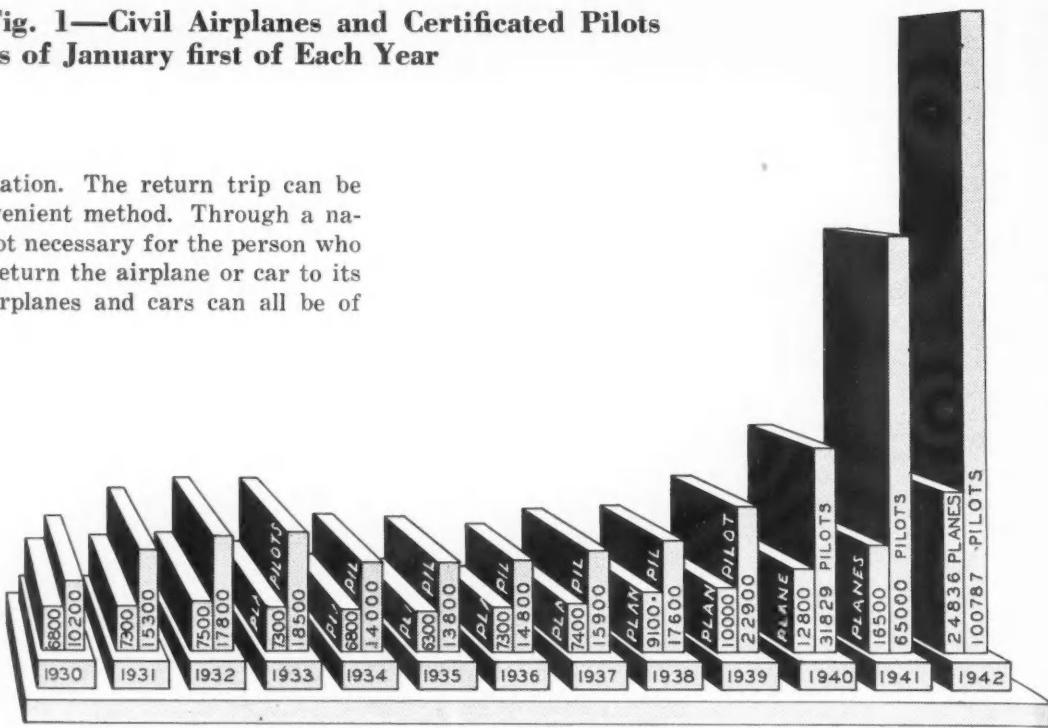
or direct to the destination. The return trip can be made by the most convenient method. Through a nationwide service it is not necessary for the person who originates the trip to return the airplane or car to its starting point. The airplanes and cars can all be of similar design and therefore can be serviced at any station.

One of the biggest advantages of this plan is that it is an individual service and lends itself to extreme flexibility of scheduling. You make your own schedule, which is one of the important

factors responsible for the popularity of car travel between cities. This plan is a case of combining the two.

An operation of this type assures the traveler of good equipment, always correctly serviced, at a reasonable cost. He is relieved of all of the responsibility of having to return the airplane to its original base, in case he cannot make the return trip by air, or to continue a trip by air in case of bad weather. There are many other advantages which become self-evident as we study this plan.

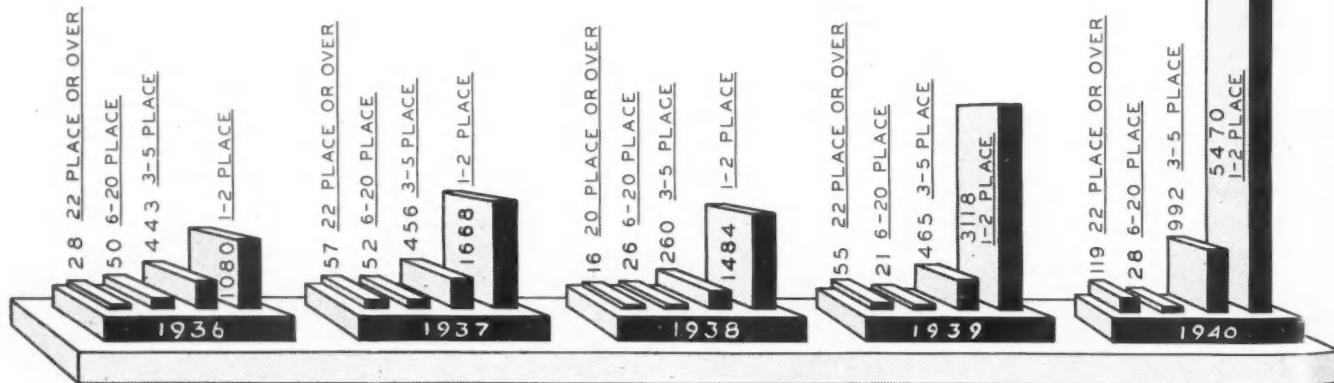
The easier the airplane is to fly, the more popular will the service become. The helicopter offers many possibilities in this field because the landing facilities can be located closer to the city limits and in many cases even within the city. But the helicopter still needs to grow through more development and, for this reason, the operation may have to use more conventional aircraft at the start and fly the helicopter for



mail and express on short runs until the development reaches the stage where it can be released for private use. To make reasonable progress on the helicopter development will necessitate an early start.

In the meantime there will be a good market on this plan for a good airplane having a reasonably high cruising speed, good landing speed, good visibility and comfortable cabin. At the beginning of 1942, there were only 24,836 certificated civil airplanes of all types. Many of these are obsolete and worn out. Even in 1942, the ratio of pilots to airplanes was about 8 to 1. Omitting the obsolete airplane, the ratio is much higher. At the end of the war, most of the present civil airplanes will be obsolete. We will therefore have a large number of pilots, but no civil airplanes. The military type airplane will be of little value for the Fly-A-Plane-Car Service. Therefore the development of this plan provides an excellent potential market for the

Fig. 2—Production of Civil Airplanes by Types



Sikorsky helicopter equipped with rubber floats for water, ice or land operation. This three-place machine is powered by a 100-hp engine and its gross weight (loaded) is 1500 lb.



right airplane and, more important than this, it provides the right kind of employment for the pilots and mechanics. Further, it places aircraft in its correct position in the field of transportation.

Statistical support for this plan can be obtained from a study of existing data on the quantity of airplanes available, who flies them, how are they distributed geographically, and how does the cost compare with other factors affecting the problem. In some cases data on these questions are only available up to the end of 1940, while in others information can be obtained to the present date. Any analysis of this information must account for the immediate prewar and present war conditions. In the interest of the war effort, some data cannot be disclosed and this fact must also receive careful consideration in the analysis.

A good answer to one of the questions can be obtained by examining the chart shown in Fig. 1. This chart was prepared from data obtained in the publication of the Civil Aeronautics Administration of the U. S. Department of Commerce. There are several points of interest in this chart. Notice how the ratio of the number of pilots to the number of airplanes has grown. In 1930, there were approximately two airplanes for every three pilots, or a ratio of 1 to 1½. But at the beginning of 1942, we find that there are over four pilots to every private airplane. This change begins with the start of 1939 and has grown to an even higher ratio now.

One of the principal reasons for this can be attributed to the Civil Pilot Training Program (CPTP) sponsored by the Civil Aeronautics Administration (CAA). Through this program thousands of pilots were trained. Most of these men were university students and a great many of them are now in the Army Air Forces. The program permitted the training of as many as ten pilots per airplane, and this is the contributing factor for the increase in the ratio of the number of pilots to the number of airplanes. Another important factor is the curtailment of commercial airplane production caused by material priorities and shortage of manpower. The recent restrictions on the sales of private airplanes both new and used, and the strict regulation of private flying in many sections of the country, will still further increase this ratio.

Nevertheless, the figures are important. As stated in the entering paragraph of this

article, by Jan. 1, 1942, there were 100,787 certificated pilots and 24,836 certificated civil aircraft. To obtain a complete evaluation we should add to this figure the 96,731 students who were holding training certificates on Jan. 1, 1942. This brings the total potential pilots at the beginning of 1942 to 197,518, and makes the ratio of pilots to airplanes 7.95 to 1. To these figures should of course be added the military pilots whose number cannot be disclosed.

Further inspection of the chart shows that in 1942 the number of pilot certificates increased to almost 10 times that in 1930 and civil airplanes increased 3.6 times for the same period. Prior to Jan. 1, 1940, the growth in airplanes and pilots was much more gradual and definitely reflects the prewar period. The effect of the present war period is shown clearly by the figures for 1940 to 1942, in which the major increase occurred.

These figures all point to the fact that there will be an appreciable number of pilots in the postwar period, who will be eager to take advantage of their flying experience, especially if this could be done as a regular part of their employment. The increased utility of the airplane through the Fly-A-Plane-Car Service plan makes this possible and insures the wider use of the smaller aircraft, either helicopter or airplane, which is necessary to make it economically feasible.

Airplane size, horsepower, and number of seats are

Fig. 3—Production of Civil Aircraft by Engine Power

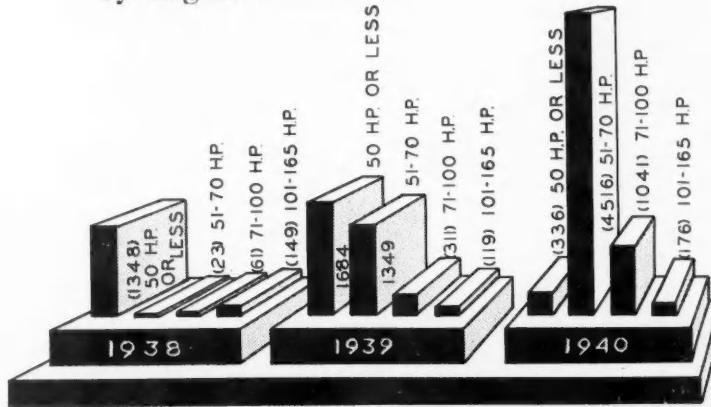
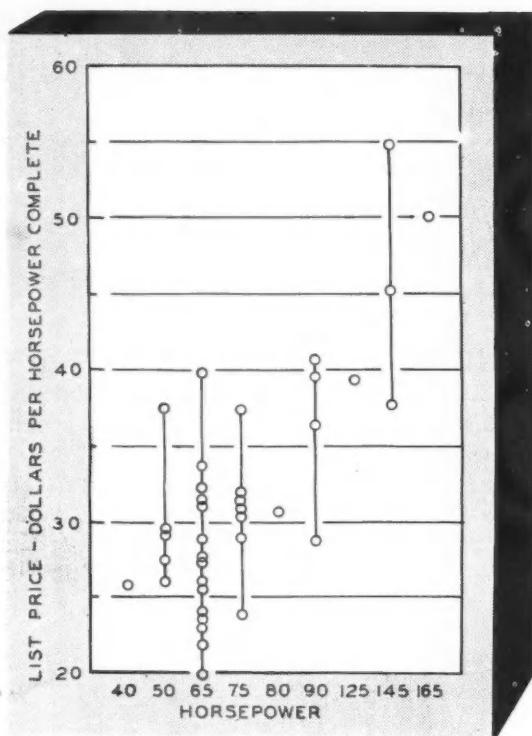


Fig. 4 — Variation of List Price of Complete Airplanes in Terms of Horsepower (1940)

Each circle represents an airplane model in production. The number of circles on each vertical line indicates the number of models in a given horsepower class.



other factors which need analysis. Up to 1940, the 1- and 2-place airplanes lead the civil production field by a large margin. The chart shown in Fig. 2 presents an interesting graphical picture of the number of airplanes in each class produced from 1936 to 1940. The big gain in the 1- and 2-place production in 1939 and 1940 is again due primarily to the CPTP program. In the case of the biggest manufacturer in the field, well over one-half of the production was trainers. Next in popularity is the 3- to 5-place airplane. This size and seating arrangement has steadily grown in

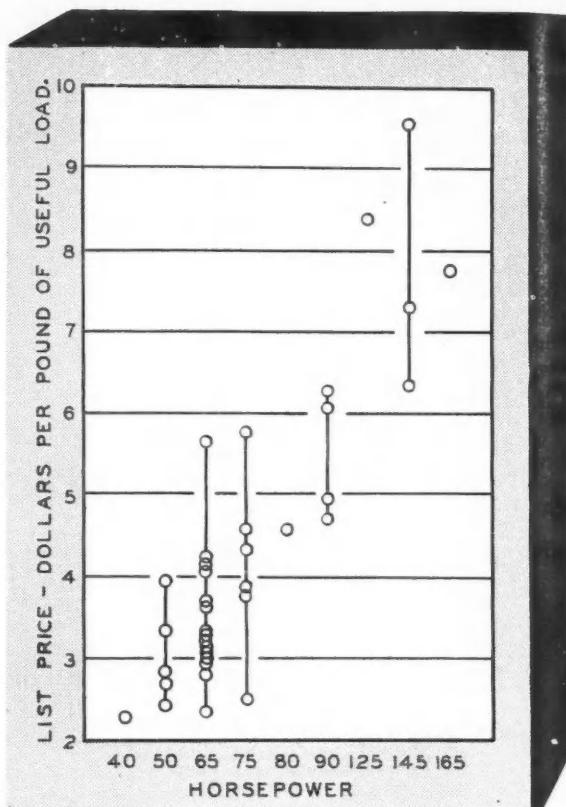


Fig. 5 — Variation of List Price in Terms of Dollars per Pound of Useful Load (1940)

Each circle represents an airplane model in production. The number of circles on any vertical line indicates the number of models in a given horsepower class.

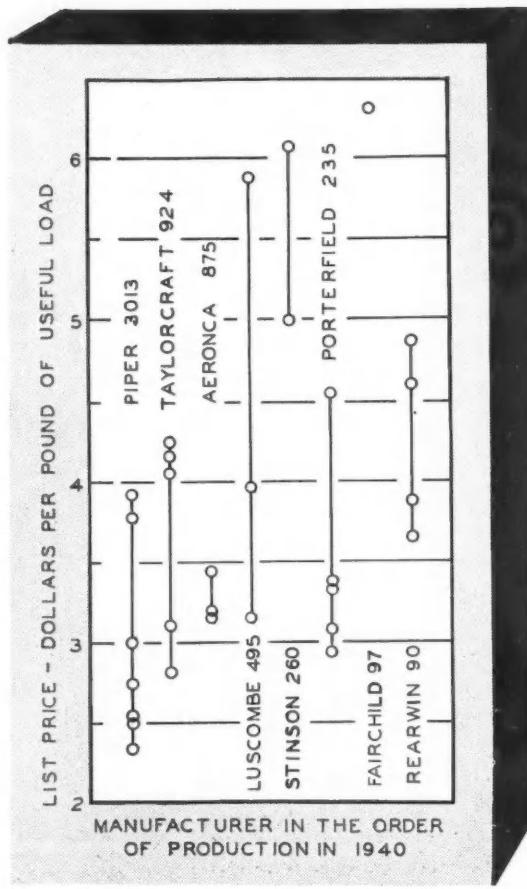


Fig. 6—Variation of Unit List Price Arranged by Manufacturer (1940)

Each circle represents a model. The number of circles on any vertical line represents the number of models for each manufacturer.

Fig. 7 — Variation of Unit List Price Arranged by Manufacturer

Each circle represents a model or type. The number of circles on each vertical line represents the number of models made by the respective manufacturer in 1940

a higher horsepower per passenger. Whereas in 1938 the 50 hp engine or less was most popular, in 1940 we find that this has changed to the range from 51-70 hp. The increase in the 71-100 hp range is also important. The selection of the power range depends largely upon the engines which are available, upon the installed cost and upon the service reliability. Information on the variation in cost per horsepower in the different power classes is shown in Fig. 4. The higher cost range in the 145 hp class is worth noting. These cost data are for 1940 and the cost variations reflect in addition to the difference in the airplanes, also the difference in the cost of the power plant. In the lower power classes, the engines are practically all of the four-cylinder opposed type. These engines employ simpler and lower cost production methods, and we now find that this

(Turn to page 84, please)

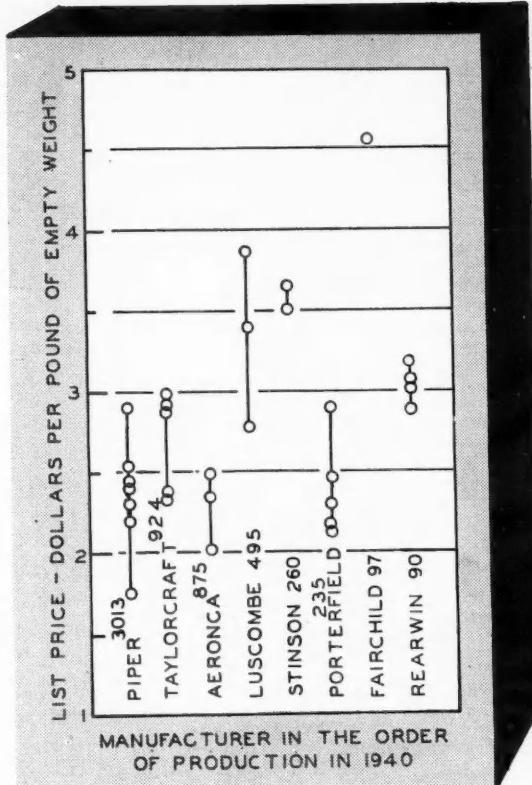
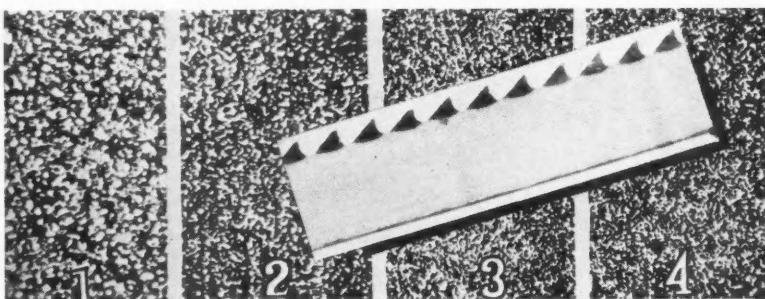


Fig. 8—Distribution of Certificated Airplanes and Pilots by States and Ratio of Pilots to Airplanes

Data as of January 1, 1942 from the CIVIL AERONAUTICS JOURNAL, February 15, 1942

State	No. Planes	No. Pilots	Ratio	State	No. Planes	No. Pilots	Ratio	State	No. Planes	No. Pilots	Ratio																																																																																																
New England																																																																																																											
Maine	203	531	2.62	Delaware	134	261	1.95	Ohio	1,286	4,251	3.31																																																																																																
New Hampshire	90	410	4.56	Maryland	373	1,155	3.10	Indiana	687	2,060	3.0																																																																																																
Vermont	75	300	4.0	Dist. of Columbia	311	816	2.63	Illinois	1,370	5,039	3.67																																																																																																
Massachusetts	594	2,527	4.26	Virginia	402	1,459	3.63	Michigan	1,017	3,820	3.76																																																																																																
Rhode Island	169	377	2.23	West Virginia	209	1,129	5.40	Wisconsin	490	1,690	3.45																																																																																																
Connecticut	274	930	3.39	North Carolina	496	1,412	2.85	East No. Central																																																																																																			
Middle Atlantic																																																																																																											
New York	1,765	7,395	4.18	South Carolina	234	1,057	4.51	Kentucky	176	649	3.69																																																																																																
New Jersey	698	2,549	3.65	Georgia	380	1,550	4.08	Tennessee	313	1,646	5.26																																																																																																
Pennsylvania	2,357	5,354	2.28	Florida	564	2,500	4.44	Alabama	185	977	5.28																																																																																																
South Atlantic																																																																																																											
Delaware	134	261	1.95	Mississippi	155	774	4.99	East So. Central																																																																																																			
Maryland	373	1,155	3.10	West No. Central																																																																																																							
Dist. of Columbia	311	816	2.63	Minnesota	600	2,251	3.75	Minnesota	549	2,299	4.19																																																																																																
Virginia	402	1,459	3.63	Iowa	649	3,215	4.95	Missouri	649	3,215	4.95																																																																																																
West Virginia	209	1,129	5.40	North Dakota	129	637	4.94	North Dakota	119	644	5.40																																																																																																
North Carolina	496	1,412	2.85	South Dakota	224	1,365	6.1	Nebraska	501	2,399	4.79																																																																																																
South Carolina	234	1,057	4.51	Kansas	211	1,260	5.97	West So. Central																																																																																																			
Georgia	380	1,550	4.08	Arkansas	284	1,479	5.20	Florida	564	2,500	4.44	Louisiana	526	2,612	4.96	Mountain				Oklahoma	1,418	6,842	4.83	Pacific												Montana	170	849	5.0	Washington	448	2,515	5.60	Idaho	123	758	6.16	Oregon	334	1,601	4.79	Wyoming	102	396	3.88	California	2,404	12,053	5.01	Colorado	248	1,495	6.03	Outside of Continental U.S.												New Mexico	164	611	3.73	Continental U.S.	90	751	8.34	Arizona	156	740	4.74	Total.....	24,836	100,787	4.05	Utah	122	930	7.62					Nevada	71	235	3.31				
Florida	564	2,500	4.44	Louisiana	526	2,612	4.96																																																																																																				
Mountain				Oklahoma	1,418	6,842	4.83	Pacific																																																																																																			
Montana	170	849	5.0	Washington	448	2,515	5.60	Idaho	123	758	6.16	Oregon	334	1,601	4.79	Wyoming	102	396	3.88	California	2,404	12,053	5.01	Colorado	248	1,495	6.03	Outside of Continental U.S.												New Mexico	164	611	3.73	Continental U.S.	90	751	8.34	Arizona	156	740	4.74	Total.....	24,836	100,787	4.05	Utah	122	930	7.62					Nevada	71	235	3.31																																								
Idaho	123	758	6.16	Oregon	334	1,601	4.79																																																																																																				
Wyoming	102	396	3.88	California	2,404	12,053	5.01																																																																																																				
Colorado	248	1,495	6.03	Outside of Continental U.S.																																																																																																							
New Mexico	164	611	3.73	Continental U.S.	90	751	8.34																																																																																																				
Arizona	156	740	4.74	Total.....	24,836	100,787	4.05																																																																																																				
Utah	122	930	7.62																																																																																																								
Nevada	71	235	3.31																																																																																																								

Number of planes in the different sections of the country as of January 1, 1942.



Microphotographs taken at different points of a band saw before and after hardening.

METAL-CUTTING band saws have been materially improved in recent years, a fact that has been recognized by the aircraft industry, which is using many such saws. The improvements came as a result of a series of laboratory tests to determine the reason why certain saws which appeared to be of high quality, would not stand up for any length of time in severe service, particularly in contour sawing. The laboratory tests showed that the ability of a saw to withstand severe cutting tests is largely dependent on the depth of tooth hardness. Microscopic examination of all saws in which teeth had ripped out or which had lost their set showed that in nine cases out of ten the failure was due to improper depth of tooth hardness.

In an accompanying illustration are shown four micrographs of different sections of a so-called contour saw, taken at different stages in the production process. Micrograph No. 1 is of the raw band steel as it came from the mill. It will be noted that here the cementite represented by the white dots, is uniformly distributed, which assures that the back of the band will have uniform mechanical qualities. Micrograph No. 2 represents a section near the center of the band after it has been hardened. In the heat-treating process this part of the band was raised to a sufficiently high temperature to break up some of the cementite particles. This results in a tougher structure with more stability and longer flexing life. Micrograph No. 3 was taken at a point located about centrally on the hardened saw tooth. Here a further transformation has resulted in a finer distribution of cementite particles, which latter are firmly held in a matrix of hardened steel. This particular structure is very hard, showing from 60 to 62 Rockwell C.

Micrograph No. 4 was taken at a point close to the tip of a saw tooth. At this point there is a still finer distribution of cementite. The variation of the grain structure as described indicates that in the heat treatment the different parts of the saw are raised to different temperatures, the lowest temperature being applied to the back of the band

Teeth of band saws hardened to incorrect depths.

Improved

and the highest to the tip of the tooth. By means of a recently developed acid test the hardness can be checked for every foot of length of the saw.

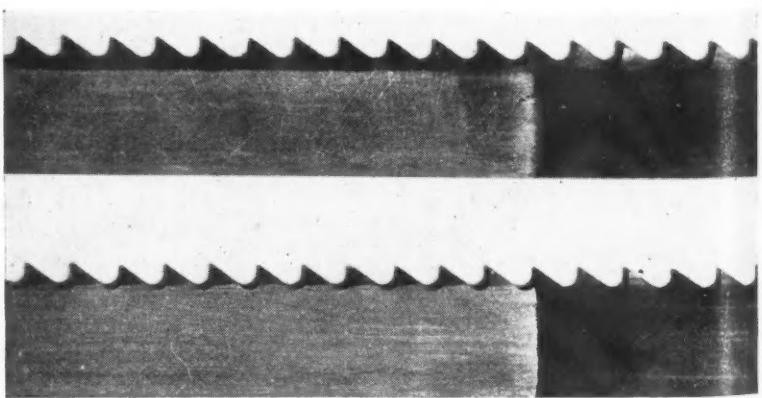
A saw thus hardened has teeth that are very rigid down to the bottom of the gullet, where the hardness ends. At this point the material becomes more elastic, allowing minute movements of the teeth and preventing their breakage when subjected to side pressure, as in contour sawing. A saw hardened in this way will last proportionately longer in "straight" sawing.

Photographs of two saws are reproduced here showing the demarcation line between the hard and brittle and the more flexible section as brought out by the acid test. In the upper specimen the demarcation line is too low, which means that the hardening effect has penetrated too deeply. In such a saw the tooth cannot yield elastically when side pressure is applied, nor can bending take place at the gullet. If subjected to severe service the teeth will break, and most likely they will carry parts of the band with them.

Therefore, it can be concluded that with constant flexing and normal stretch of the band, if the hardness extends too deeply, small cracks will form at the bottom of the gullet, and as these cracks become deeper, the teeth either will break or lose their set. If the hardness does not extend sufficiently deeply, as in the lower specimen, the tip of the tooth will be hard but the base relatively soft, so that whether the saw is used for contour sawing or straight sawing tough materials, the teeth will rapidly lose their set, which is as bad as if they broke off.

Recommendations for Sawing Various Materials

Duralumin, better known as Dural, can now be cut faster and with a better finish. A 6-pitch saw should be used for thickness of $\frac{1}{2}$ in. and over. Finer



Band Saws

By H. J. Chamberland

pitches will become "loaded" quickly and have their teeth destroyed. An 8-pitch saw is advisable for $\frac{3}{8}$ -in., a 10-pitch for thinner stock. The linear velocity of the saw should be 1000 fpm for a 1-in. thickness, but this can be increased or decreased to meet

All stainless steels have a tendency to heat rapidly, and for this reason velocities should not exceed 100 fpm. A light pressure and the use of a coolant are recommended to get satisfactory saw life, rather than to achieve high production.

Recommendations for Band Sawing NE Steels

Material Thickness	Saw Pitch	Saw Velocity	Feeding Pressure
$\frac{1}{16}$ " or less	24-32	225	Light (hand)
$\frac{1}{16}$ " to $\frac{1}{2}$ "	24-14	200	Light (hand)
$\frac{1}{2}$ " to 1"	14-8	175	Light-Medium (mechan)
1" to $2\frac{1}{2}$ "	8	150	Medium (mechan)
Over $2\frac{1}{2}$ "	6	125	Medium-Heavy (mechan)

requirements. The feed pressure should not exceed 40 lb. Vibration marks indicate the advisability of lower saw velocities. A kerosene drip will improve the finish.

Repeated experiments have shown that the Grade A of nickel silver can be cut most economically with a 10-pitch saw operating at 200 fpm. Permissible cutting speeds drop rapidly with an increase in pitch number, which is a good reason for avoiding finer pitches. With saws of finer pitch, moreover, the material heats quite rapidly. Leaded nickel silver is an alloy similar to the foregoing, but with lead added to improve its machinability. It reacts in a similar way to Grade A to fine pitches and to too high saw velocities, but the permissible cutting rate is 7 in. per min., as compared with 2 in. for the Grade A.

Nickel aluminum bronze does not saw well, there being a tendency for chips to pile up even at the moderate velocity of 300 fpm. The best combination for sawing this material is a 10-pitch saw running at 200 fpm, which gives a cutting rate of about 1.5 in. per min. The foregoing recommendations apply also to beryllium copper, but the cutting rate for that alloy is 35 to 40 per cent higher.

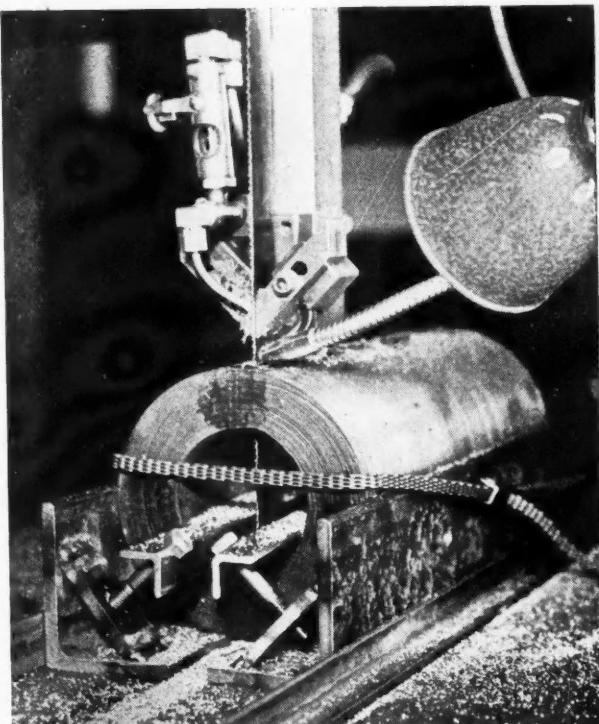
With copper tubing, which is used quite extensively in aircraft, the problem is to avoid burrs. A 14- or 18-pitch saw without set at 1200 fpm gives very good results. A regular 24-pitch raker-tooth saw is a poor substitute.

The technique employed in sawing the very tough chrome-molybdenum steel remains about the same, saws with from 10- to 18-pitch teeth and running at from 100 to 125 fpm being used, depending on the thickness of the stock. However, with a good flow of coolant the new saws will stand a much heavier feed than the earlier ones.

Sawing tests are being made regularly on the National Emergency steels, and on steels ranging from 8024 to 8929 these have progressed sufficiently so that at least recommendations of a general nature can be made. In the first place, a raker-set tooth of temper A should always be used,

and on these steels a saw life equal to from 600 to 1000 sq. in. of material cut may be expected. A saw of 1-in. width should be used on thicknesses over 2 in., and of $\frac{1}{2}$ in. width on thicknesses from $\frac{1}{2}$ in. to 2 in. This, of course, applies to straight sawing. In

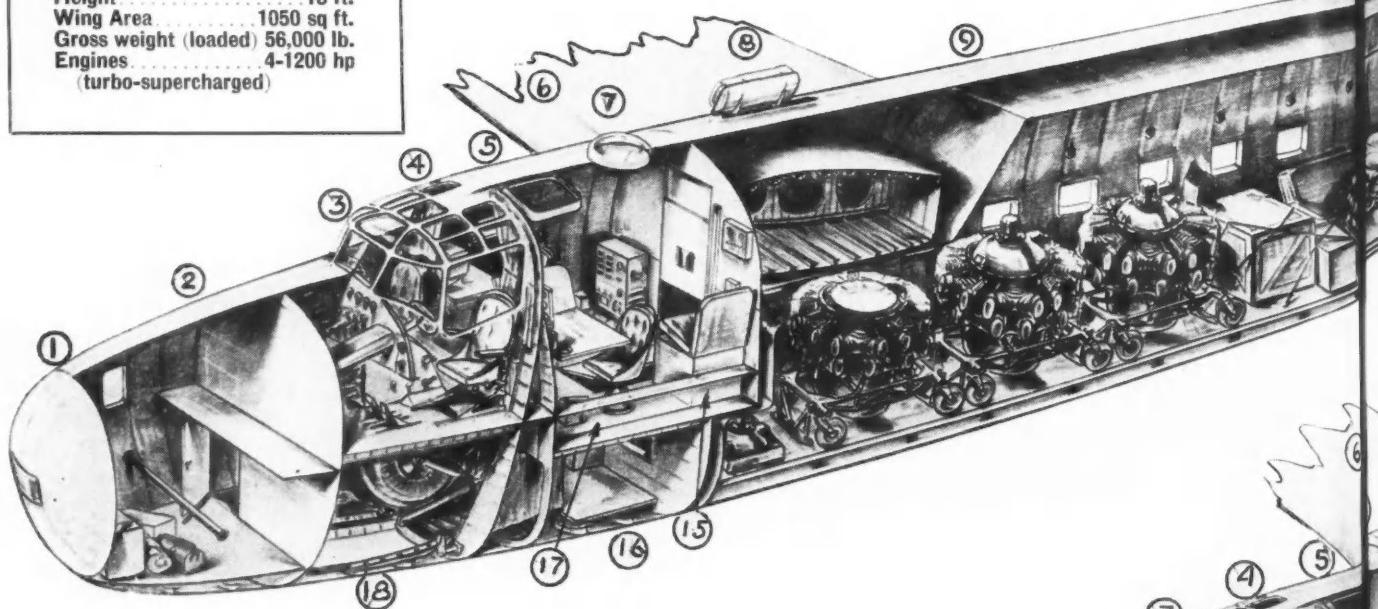
(Turn to page 44, please)



Improvised setup used to determine correct sawing technique for cutting large tubular steel stock in half.

LIBERATOR DATA

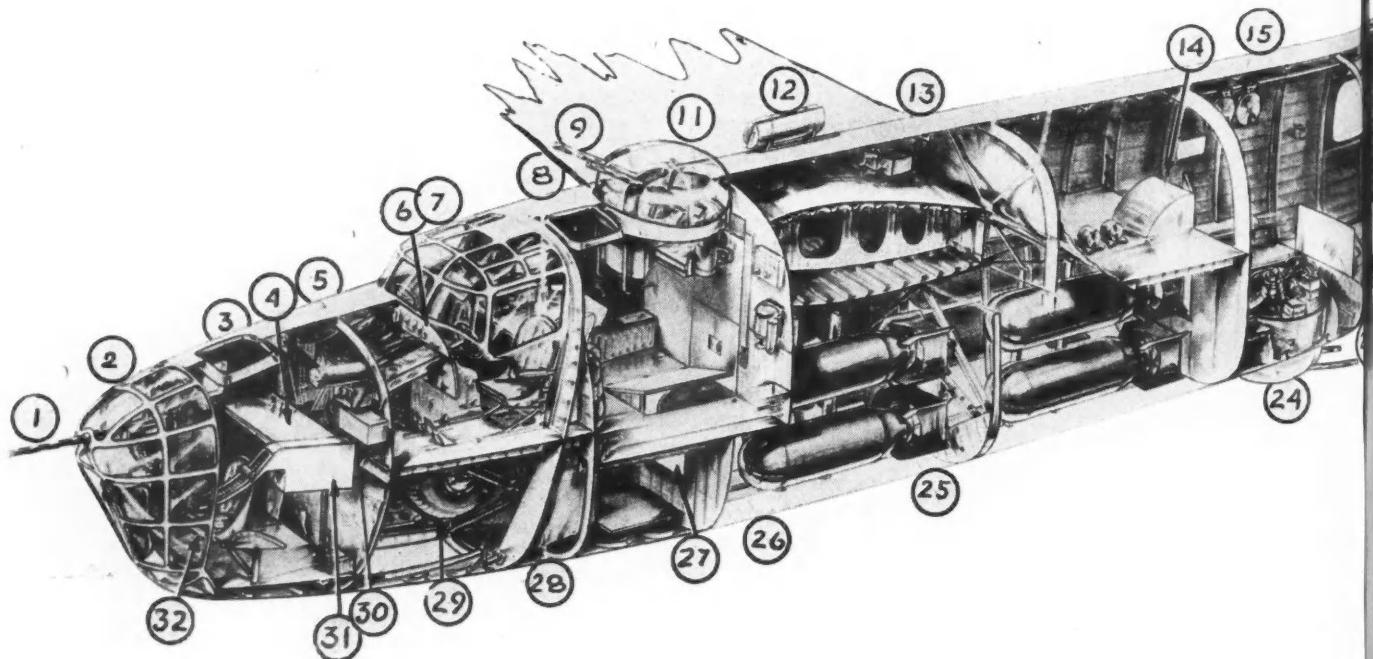
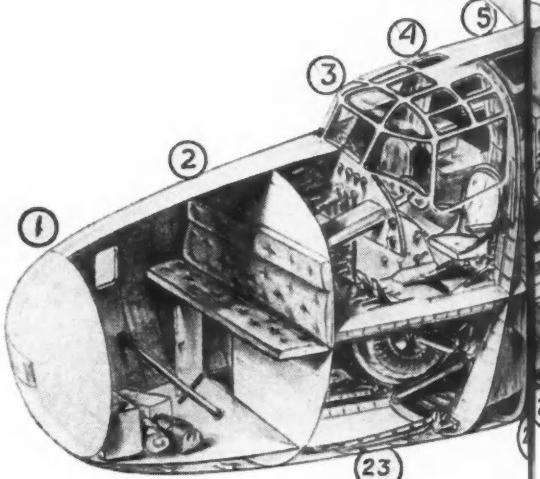
Span 110 ft.
 Length 66 ft 4 in.
 Height 18 ft.
 Wing Area 1050 sq ft.
 Gross weight (loaded) 56,000 lb.
 Engines 4-1200 hp
 (turbo-supercharged)



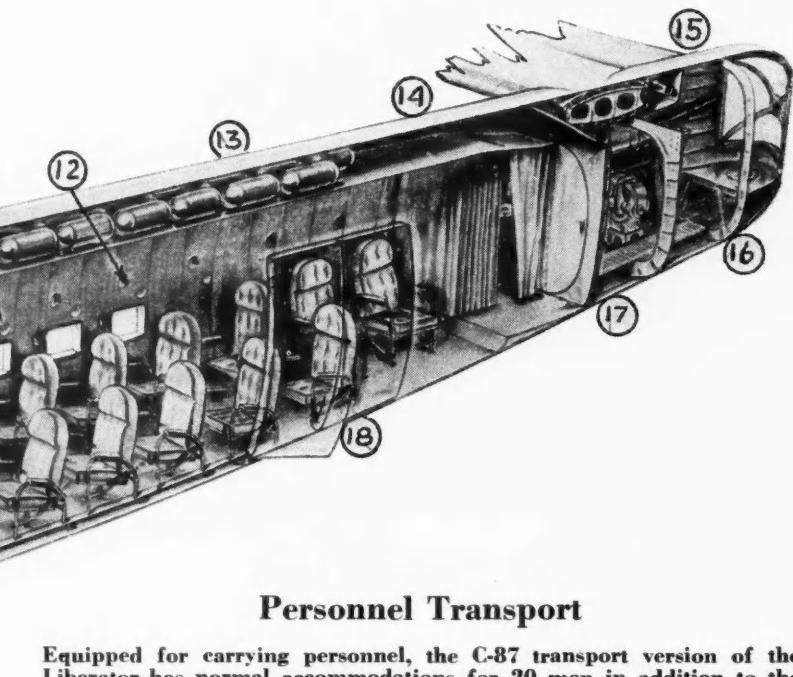
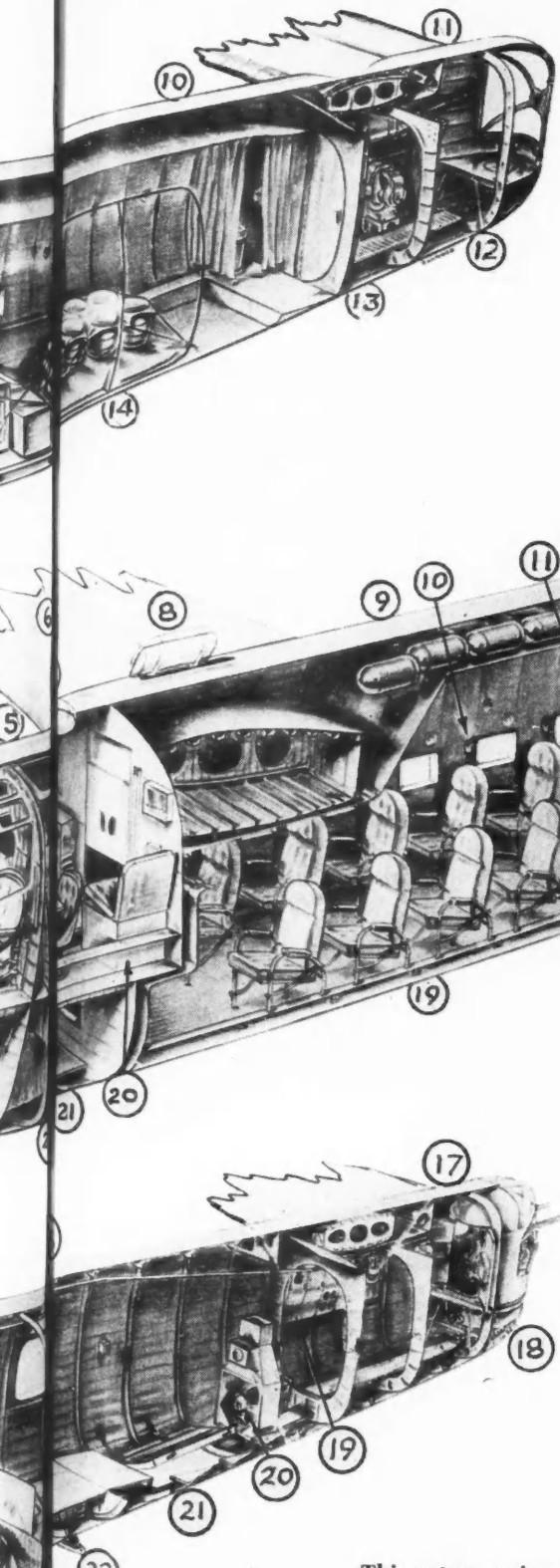
Cargo Transport (Above)

The Liberator C-87 Express was developed in response to the Army's decision to fly imperative military supplies to the active fighting fronts all over the world. Elimination of bomb bays and gun turrets, the addition of a cargo hatch near the tail section and the substitution of an unglazed nose were the chief structural changes made in modifying the C-87 from the Liberator bomber.

- | | |
|--------------------------------|-----------------------------|
| 1. Large Loading Door | 10. Wash Room & Toilet |
| 2. Aux. Seat in Baggage Comp't | 11. Cal. 50 Gun—Stowed |
| 3. Pilots | 12. Gun Mount in Tail Door |
| 4. Radio | 13. Warm Air Blower |
| 5. Escape Hatch | 14. Loading Door |
| 6. Fuel in Wing | 15. Locker & Extra Seat |
| 7. Astrograph Dome | 16. Entrance to Flight Deck |
| 8. Life Raft | 17. Navigator |
| 9. Sound Proofing | 18. Nose Wheel |



Three Versions of the *Liberator*



Personnel Transport

Equipped for carrying personnel, the C-87 transport version of the Liberator has normal accommodations for 20 men in addition to the crew. Stripped of armament it depends for protection upon evasive action or fighter escort.

- | | |
|--------------------------------|-----------------------------|
| 1. Large Loading Door | 13. Oxygen Supply |
| 2. Aux. Seat in Baggage Comp't | 14. Wash Room & Toilet |
| 3. Pilots | 15. Cal. 50 Gun—Stowed |
| 4. Radio | 16. Gun Mount in Tail Door |
| 5. Escape Hatch | 17. Warm Air Blower |
| 6. Fuel in Wind | 18. Entrance Door |
| 7. Astrograph Dome | 19. War Air Inlet |
| 8. Life Raft | 20. Locker & Extra Seat |
| 9. Sound Proofing | 21. Entrance to Flight Deck |
| 10. Oxygen Regulators | 22. Navigator |
| 11. Lights | 23. Nose Wheel |
| 12. Fresh Air Inlet | |

Bomber

This cutaway view shows the fuselage interior arrangement and armament equipment of a Liberator bomber, originally developed by the Consolidated Vultee Aircraft Corp. and now being built by that company, Douglas Aircraft Co. and the Ford Motor Co. It is designated by the Army Air Forces as the B-24 and by the Navy as the PB4Y.

- | | | |
|---|--|---|
| 1. Cal. 50 Gun | 13. Radio Equipment | 23. Armor Plate |
| 2. Airspeed Head | 14. Passage to Bomb Bay | 24. Bendix Power Driven Turret Retractable 2 Cal. 50 Guns |
| 3. Emergency Exit | 15. Tail Gun Ammunition on Mono Rail | 25. 8—1100 lb. Bombs Shown |
| 4. Navigators Table | 16. Emergency Exit | 26. Keel-Walk Way |
| 5. Navigators Equipment | 17. Turret Actuating Hydraulic System | 27. Passage to Bomb Bay |
| 6. Controls | 18. Consolidated Hydraulic Power Turret—Armored 2 Cal. 50 Guns | 28. Nose Wheel Splash Curtain |
| 7. Pilots Seats Armored | 19. Tail Control Shield | 29. Nose Wheel |
| 8. Radio Table | 20. View Finder K 7-C Camera | 30. Draft Curtain |
| 9. Emergency Exit | 21. Entrance & Camera Hatch | 31. Ammunition |
| 10. Martin Power Driven Turret Non-Retractable 2 Cal. 50 Guns | 22. Retracting Tail Bumper | 32. Bombardier—Navigators Seat |
| 11. Self Sealing Cells in Wing | | 33. Bomb Sight |
| 12. Life Raft | | |

AT one of the branch plants of Lockheed Aircraft Corp. near Los Angeles, streamlined, supplementary fuel tanks of the droppable type are being produced for Lockheed Lightning P-38s, Vega Ventura bombers, and other American aircraft. Each tank weighs 90 lb when empty and 1000 lb when filled with 165 gals of gasoline. Two such tanks when clamped beneath the wings will approximately double the normal range of the Lockheed Lightning. Even without this auxiliary equipment it is this country's longest-range fighter. Owing to careful streamlining of the installation, the two tanks, when full, reduce the top speed of the plane only about 4 per cent.

Detachable supplementary fuel tanks have long been used in long-distance overseas flights, but the earlier designs were not entirely satisfactory. Lockheed, for instance, obtained such tanks of aluminum construction from a nearby subcontractor. The first 2000 of these had cost the Government \$678 apiece. The Army, therefore, made an urgent request for a tank that would cost less, use no critical material, and be adaptable to a much higher rate of production. An order was placed with Lockheed by the United States Army Air Forces which called for production in 90 days. At the time the order was signed, Lockheed not even had drawings of the tank on the

boards, yet the time limit was met, and at present these tanks are coming off the assembly line at the rate of one every 4½ minutes. In the production of these tanks use is made of a novel conveyor line and of ingenious spot, roll and seam-welding equipment.

Chief production engineer Harold Harrison was given the job of designing the tank. The first design provided for making the shell in quarters, but this was superseded by a plan according to which the tank is made in the form of half-shells, and after this second design had been subjected to extensive vibration tests, it was adopted as the production model. It is made of SAE No. 1010 auto-body steel, of 0.024 in. thickness. The sales price of these tanks is less than \$100.

By
Fred
Ho

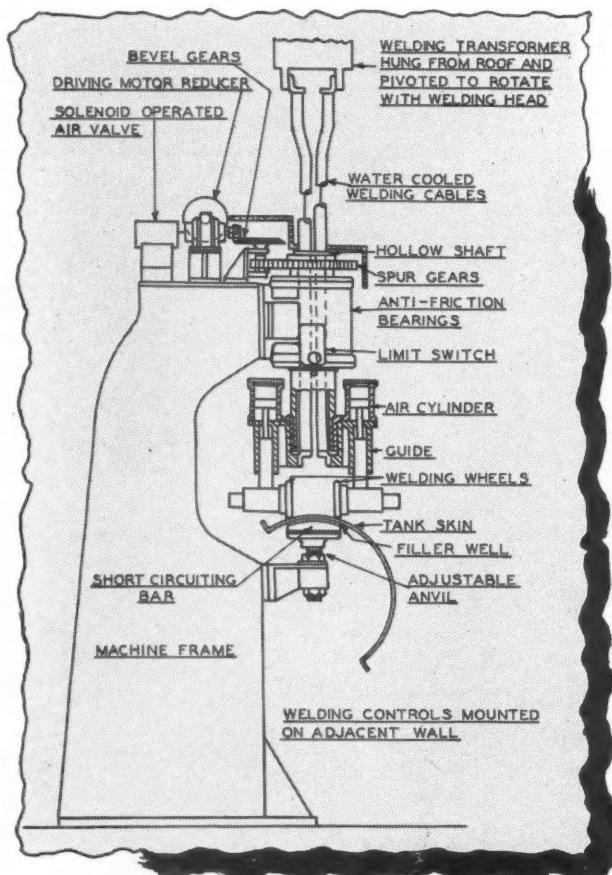
Produ
Develo
Lockh

Droppable

To the Manufacturing Engineering Department, under Marlin W. Coker, was assigned the task of designing a conveyor system that would turn out 130 tanks per day. A manufacturing engineering group under L. H. Ferrish evolved a system that made it possible to more than double this rate of production. Novel spot-roll and seam-welding equipment was conceived by Harry Chiles of the Lockheed Plant Engineering Department and developed in collaboration with the Plant Engineering Design group. Two of these special welders—a portable seam welder and roll-spot welding fixture—are believed to be the first of their kind to be built in this country.

Plant No. 4 was selected as offering the best possibilities for the project, and it was decided to use a continuous conveyor on which to perform the assembly operations on the tank. Much of the equipment needed was obtained from plants which had no longer any use for it because of conversion to war production. The conveyor lines themselves, of which there are two, were purchased from the Studebaker Corp., with a proviso that Studebaker can repurchase them at the end of the war.

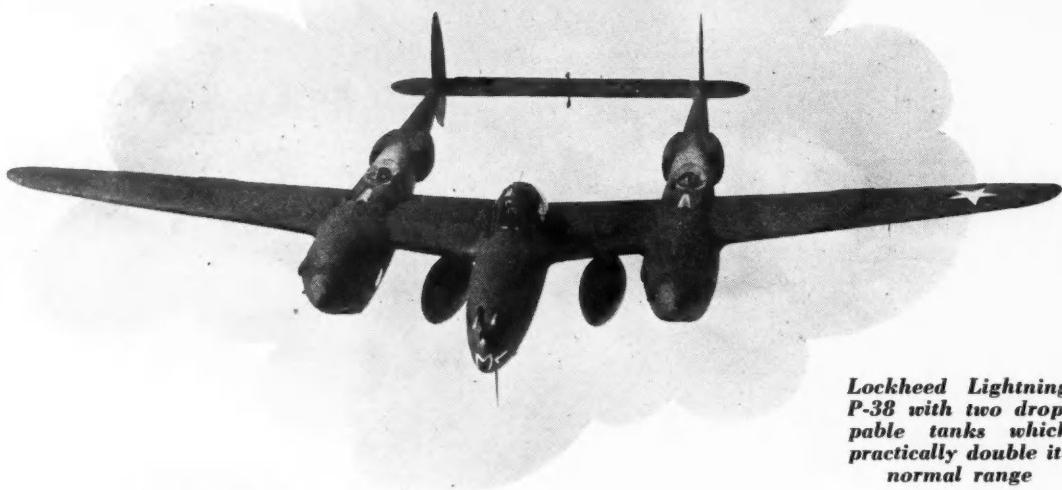
The layout consists of an overhead conveyor from which the cradles are suspended, each cradle holding one tank, and the complete assembly conveyor holding 36 cradles. The welding and assembly machines and stands are located at various stations along the conveyor line, in the sequence in which the operations must be performed. The tank leaves the first conveyor line to enter a slushing booth, where its inside is



Filler-well series seamwelder with half-shell of tank in position

By
**Fred. C.
Hoffman**

Production Design
Development Engineer,
Lockheed Aircraft Corp.



*Lockheed Lightning
P-38 with two drop-
able tanks which
practically double its
normal range*

e Fuel Tanks

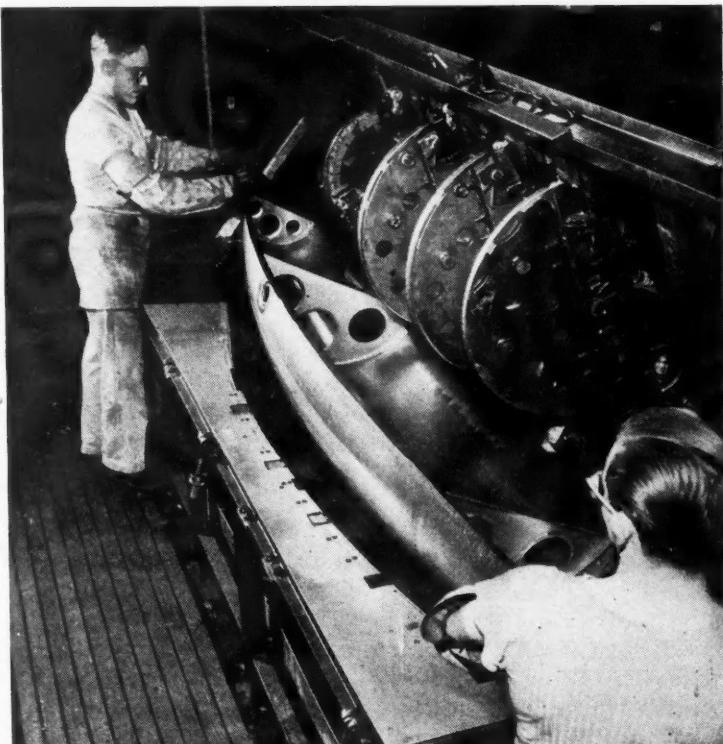
coated with a zinc-chromate primer as protection against corrosion, and is then placed on the second conveyor, which carries it through the various processing stations and finally to the platform beside the freight cars, where it is placed in a pre-fabricated crate for shipping. Before mating, left- and right-hand shells alternate on the assembly conveyor. The assembly conveyor is 475 ft long, and under the present production schedule the processing and shipping conveyor moves with a speed of 43 ipm.

All parts for the tanks are produced by subcontractors, delivered to Lockheed Plant No. 4, and there assembled. The half-shells are stamped out in hydraulic presses. The first operation at Lockheed is the torch-welding of the sump-plug flange to the left-hand shell. Next the filler-well-adapter assembly is seam-welded to the left-hand shell. The series welder, designed by Lockheed, while similar to conventional seam-welders such as those used in welding brass discs to shell cases, is somewhat unusual in that the weld is made on a double-contoured surface having a rise of $\frac{3}{4}$ in. in 90 deg. of rotation.

The machine is equipped with two air cylinders to which the shaft housings, welding shafts, and welding wheels are connected. The two cylinders and welding units are electrically insulated from each other and bolted to a casting which rotates on a hollow, ver-

tical shaft. The inside diameter or bore of this shaft is such that the water-cooled cables which connect the secondary terminals of the transformer to the cast-copper shaft housing can be brought down through the shaft. The copper-alloy short-circuiting bar, whose upper face is contoured to fit the inside of the tank, is mounted horizontally below the two welding wheels.

When the two wheels contact the tank skin, the welding circuit is closed through the short-circuiting bar. Since the welding current flows through the



*Fixture used for welding bulkheads
into droppable tank shells*



Seamwelding the adapter assembly of the filler well to the left-hand tank shell

sheets at two points, two welds are made simultaneously, and the 360 deg of welding is completed in approximately 185 deg actual rotation of the upper heads.

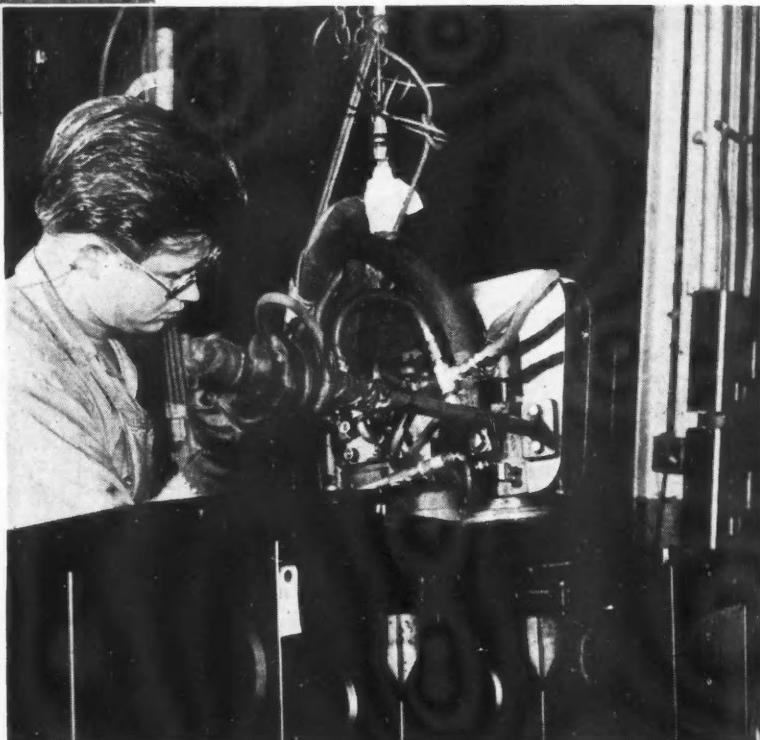
After this operation is completed, bulkheads are welded to both the left- and the right-hand skins, seven to each shell. This is done in two semi-automatic welding machines, also designed by Lockheed, the first of which welds three bulkheads in place, the second the remaining four. These two machines were designed, built and installed in ten weeks. The half-shell is placed in the machine, where it is supported at the bulkhead stations by copper-alloy electrode bars which are machined to exactly fit the outside contour of the pressed-steel tank section. Lockheed devised roll-spot-welding units which rotate about the longitudinal axis of the tank and are fastened to the hinged cover of the fixture that holds the tank sections.

Each of these units consists of a welding wheel and shaft, shaft housing, guide casting, an air cylinder of 3-in. bore by $\frac{3}{4}$ -in. stroke, a 1/12-hp driving motor, a reducing-gear box, and the necessary gear train to drive the welding-wheel shaft. The sequence panel and welding transformer are outside the fabricating jig proper. The roller spot welds are controlled by units consisting of a Westinghouse non-synchronous pulsation weld-timer panel with a Wel-o-trol electronic contactor. These timers were slightly modified by Lockheed to secure the desired sequence of operations. Except in the two center bulkheads, where they are

spaced $\frac{1}{2}$ in., the welds are spaced $\frac{3}{4}$ in. apart, center to center. Welding time is one minute in each of the two machines, but another minute is taken up by loading and unloading in each.

Next the half-shells are placed on the moving conveyor, each in its own cradle, cradles being spaced 18 in. apart. Flanged gussets and other parts which will hold the tank to the airplane are located and spot-welded to the stressed bulkheads by a series of gun welders on monorails that enable the operator to follow the tank along the floor until this particular welding job has been completed.

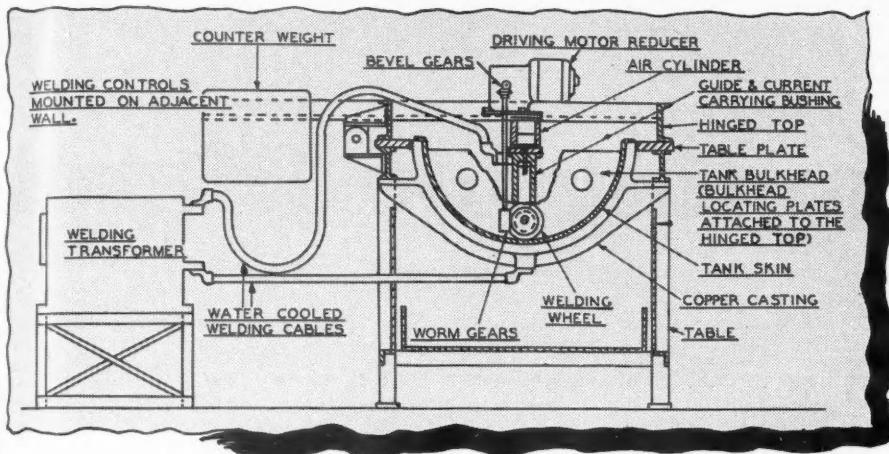
The halves of the pan are seam-welded to



The halves of the pan are seamwelded to the halves of the tank with a portable seamwelder

the halves of the tank with a portable seamwelder designed and built by Lockheed. This welder is supported from a Chicago-Pneumatic counter balancer of 175-lb capacity. Welding is done while the half-tank is on the moving conveyor. Since the linear travel of the wheels on the welder is approximately the same as that of the conveyor, the wheels are designed to rotate in the opposite direction to that of the conveyor. The result is that the welder actually moves less than 18 in. during the welding operation.

Various other small parts are put in place, until the tank has passed through a total of nine welding stations, three of which are seam- or roll-spot welders. Meanwhile, fuel lines and vents are gas-and tack-welded in place, and the attachment hooks are bolted



Section of one of the roll-spot-welding units of the bulkhead welder

in place by means of power-driven socket wrenches.

After a final clean-up to make certain that there are no loose parts, the right- and left-hand shells are mated and clamped together, prepunched holes in the standing seams being used to properly register the halves. The parts are tack-welded together by a gun-welder, and the tank is taken off the line and placed in a special cradle and run through a National seamwelder that completes the mating operation. This seamwelding is done at the rate of 60 in. per min., the time required per tank being 4 mins.

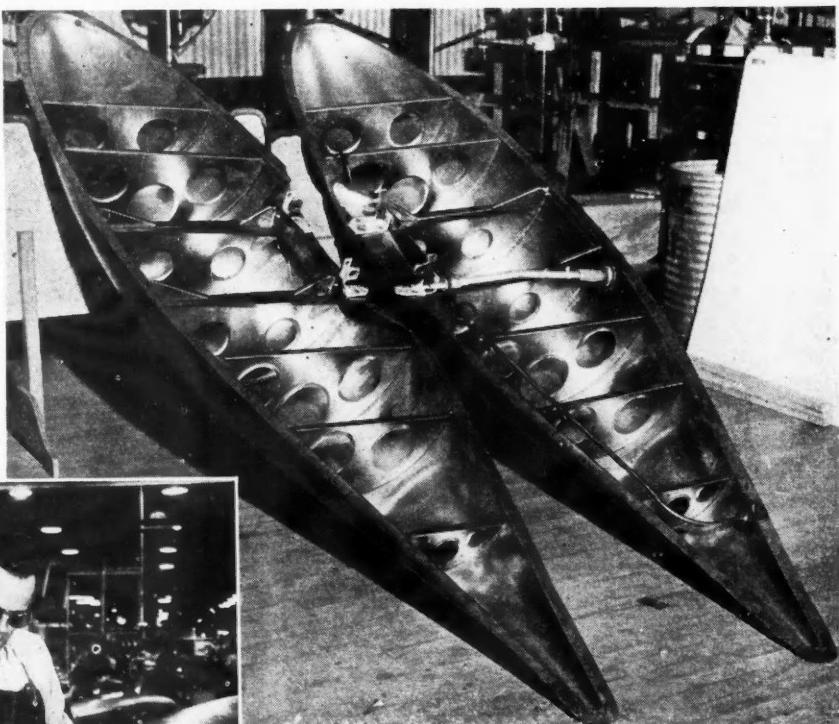
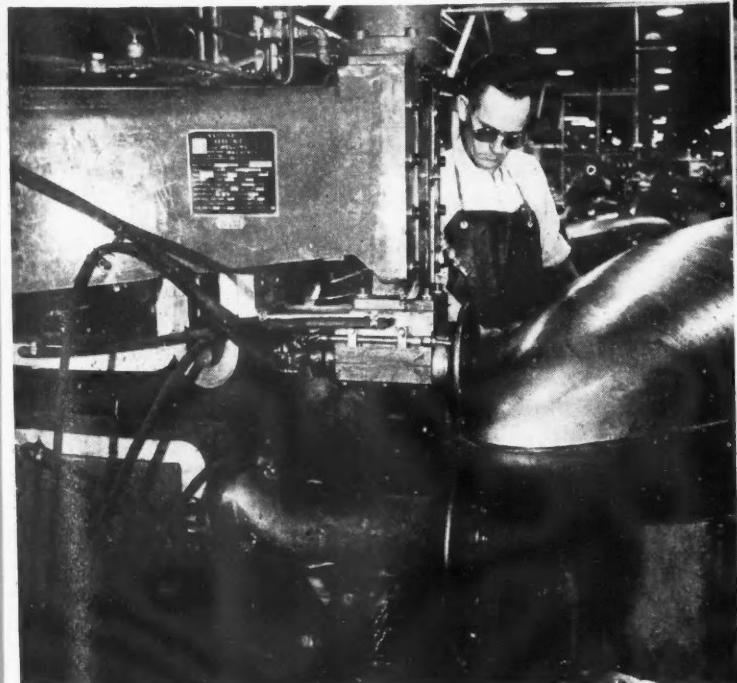
Excess material on the standing seam is trimmed off with an electric shear, the tail-plug flange

is torch-welded in place, and the tank is placed back on the conveyor. There with air pressure in it, soapy water is applied to the outside to test for leaks. If any leaks are revealed the tank is repaired immediately.

The tank is now ready for the "slushing table," which holds two tanks, one on each side. Into each tank is

poured 30 gals of zinc-chromate primer. The table is rotated so that the fluid passes over every portion of the inside of the tank, after which the tank is loaded onto a drying dolly and dried with a hot-air hose.

Seamwelding tank halves together at the rate of 60 ipm on a National Electric Welding Machine



The two shells with all bulkheads and interior fittings in place, ready for mating

Next the tank is given a final pressure test, the permanent tail plug is screwed in place, and the tank is placed on the second or process conveyor. This conveys it in turn through a hot Turco bath cleaning solution, a cold-water rinse, a drying oven, and a paint booth where two primer coats and the final camouflage coat are applied. This same conveyor then carries the tank out through a window into the shipping building, where

(Turn to page 64, please)

Cold Starting for Diesel E

INSTEAD of measuring the torque required in cold starting mechanically and calculating the power developed by the starter from this torque and the cranking speed, as was done by Mr. Knudsen, it is possible to record the factors of electrical input into the starting motor—the terminal voltage and the current. Such records can be obtained by means of oscillographs, and oscillographs of starting current and voltage were given in a paper by W. J.

Pelizzoni, manager of the testing laboratory of International Plainfield Motor Company. These records were taken when starting a six-cylinder Diesel engine of about 500 cu in. displacement. Fig. 5 is an oscillogram obtained when making a start after the cooling system of the engine had been raised to 74 F with an electric immersion heater of 1100 watts capacity. It will be seen that for the breakaway a current of about 775 amps at 17 volts is required. The current drops rapidly and the battery voltage rises correspondingly, and owing to the relatively high temperature of the cylinder, firing begins almost immediately. It remains somewhat irregular for about 8 seconds, but from there on the engine runs steadily under its own power. This oscillogram is evidence of the efficiency of the immersion heater as a starting aid.

In contrast to the above, Fig. 6 is an oscillogram of the start of a 600 cu. in. engine without starting aids at 38 F. Here the amperage at the breakaway was so high that it could not be recorded. Two early partial explosions had practically no effect on the current consumption, and the first powerful explosion took place only after about 3.5 seconds of cranking at 168 rpm. Partial firing continued for another 7 seconds, and raised the cranking speed to 260 rpm, after which the firing became regular.

Electric current for heating the engine or the air charge of the cylinder may be derived either from the vehicle battery or from service mains. It has been pointed out already that electric current is used most economically in glow plugs, and current for such plugs is always taken from the battery. It evidently takes less heat to warm the air entering the engine directly by having it pass over a heating element in the manifold than by supplying heat to it via the cooling

By P. M. Heldt

fluid, and when heating elements in the air passage are used, they are operated with battery current. Such heating units can be operated either as pre-heaters, by supplying them with current for a certain length of time prior to switching on the starting current, or they can be used as combined preheaters and cranking heaters, by keeping them in circuit with the battery while the engine is being cranked. Such heating units in the air passages must be located as close to the inlet valves as possible, in order to reduce the loss of heat by the air on its way to the cylinder. Leaving the heater on while the engine is being cranked is of doubtful value, since the heater load reduces the battery terminal voltage, and therefore the cranking speed.

Another type of electric heater used as a starting aid is known as an immersion heater and is incorporated in the cooling system of the engine. Such heaters may be connected to a source of current supply when the engine is being shut down, and will then reduce its cooling rate and raise its equilibrium temperature. Mr. Pelizzoni found that with an ambient temperature of zero F, an engine with 6 gals coolant capacity when shut down while at 170 F will reach the ambient temperature in about 16 hrs. under the same ambient-temperature conditions, with an immersion heater of 500-watts capacity in the system, the equilibrium temperature will be about 35 F and will be reached in about 12 hrs, while with a 1100-watt heater the equilibrium temperature will be about 75 F and will be reached in a little more than 8 hrs. Heating engines with such heaters from very low temperatures is a slow process. For instance, with an ambient temperature of zero F the engine with 6 gals coolant

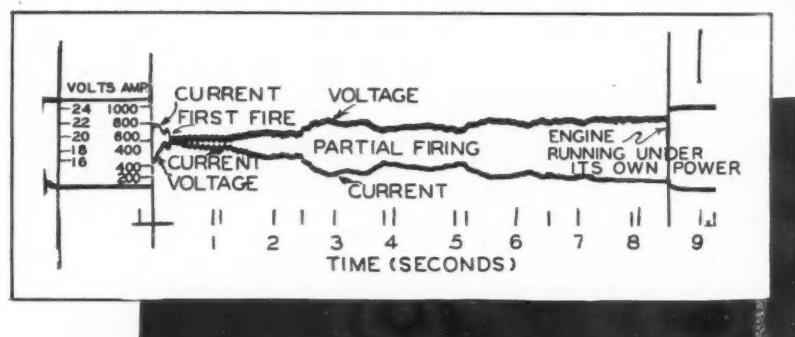


Fig. 5—Oscillogram of starting voltage and current, starting 500-cu in. Diesel engine at zero F ambient temperature, with cylinder coolant raised to 74 F by an immersion heater

Engines

Part Two

Part One appeared in the May 1, 1943, issue of AUTOMOTIVE and AVIATION INDUSTRIES.

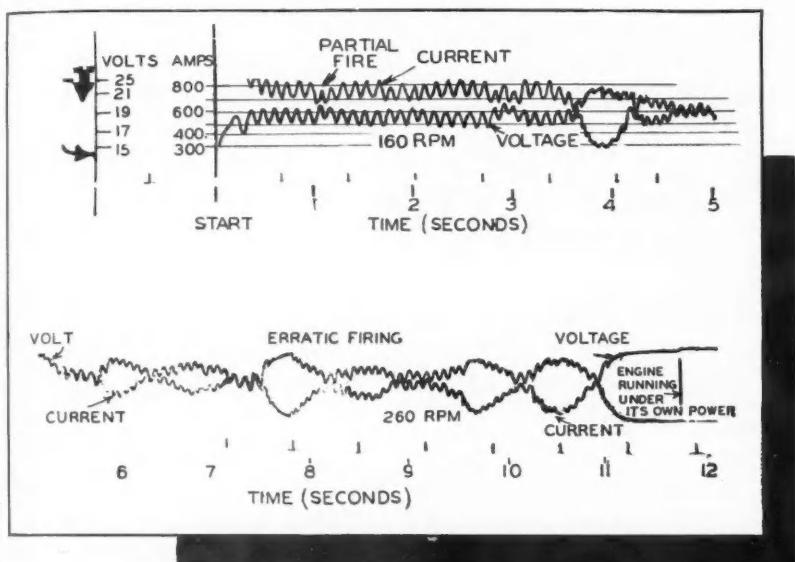


Fig. 6—Oscillogram of starting voltage and current when starting 600-cu in. Diesel engine without accessories in place, at 38 F

capacity can be brought in 2 hrs to 13 F with a 500-watt, and to 30 F with a 1100-watt heater, while in four hours it can be brought up to 22 F with the 500-watt, and 52 F with the 1100-watt heater. A 2200-watt heater will raise the engine temperature to 40 F in about one hour from minus 30 F. The immersion-type heater is quite simple and easy to operate, and its only drawback is that it can be used only where there are service mains.

More rapid heating of the engine than by electric means can be achieved by means of oil burners similar in their principle of operation to domestic oil heaters. Combustion of the oil takes place inside the induction system of the engine. Only a fraction of the air entering the induction system is used for the combustion of the oil, and the products of combustion enter the cylinder together with the remaining air. One would expect that contamination of the air charge with products of combustion would render starting more difficult, and it has been found that this type of heater is most successful on supercharged engines in

which the amount of air entering the cylinder per cycle greatly exceeds the piston-displacement volume at atmospheric pressure and temperature. For a given amount of heat generated by the burner, the contamination will be less in such an engine, and the chances of ignition therefore are greater. Heaters of this type are much used in connection with two-stroke engines, in which the heater is assembled on a special cover for the air box that surrounds the lower portion of the cylinders, and combustion of the heater oil takes place in this air box, from which the mixture of air and combustion gases passes into the cylinder through ports at the bottom of the stroke. The heater outfit (Fig. 7) consists essentially of two assemblies, one comprising a pressure pump and an ignition switch, which may be mounted on the driver's cab, the other a spray nozzle, a vibrator coil, and

spark points or igniter points, which are mounted on the airbox cover. By means of the pressure pump and an air dome connected to the line, a substantially uniform pressure is maintained on the fuel. Combustion

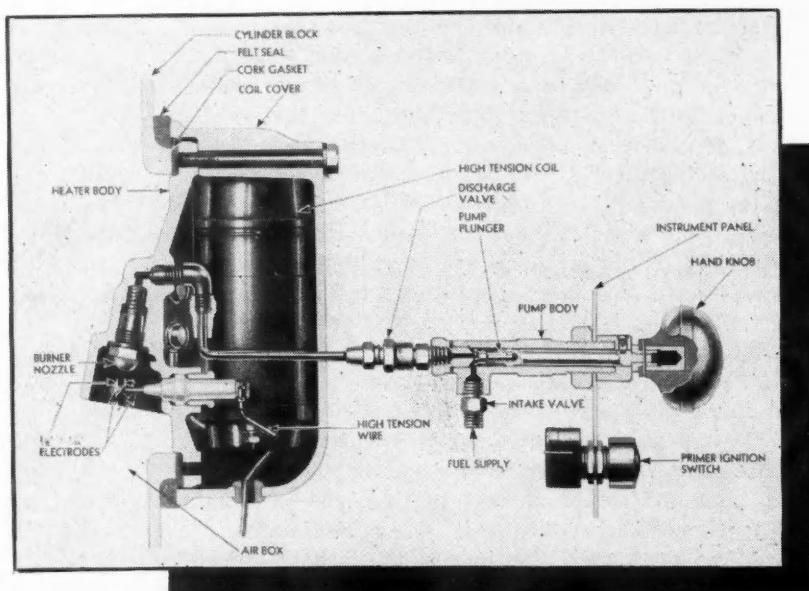


Fig. 7—Sectional assembly view of flame-primer installation on General Motors two-stroke engine

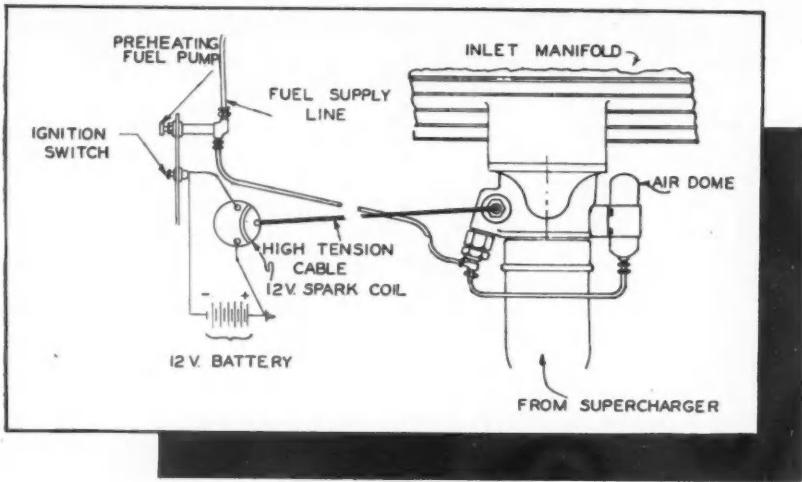


Fig. 8—Flame primer installation on four-stroke engine, for heating air in inlet manifold.

can begin only when the air begins to flow, that is, when cranking begins. The fuel supply to the burner must be so adjusted that the proportion of the total air supply consumed in its combustion is not excessive, as otherwise it might be impossible to ignite the fuel injected into the engine, even though the cylinder temperature were sufficiently high. Owing to contamination of the air charge, the first few combustions in the cylinder are likely to be rather weak, but with increase in engine speed the burner nozzle delivers less fuel per engine cycle, hence less of the air will be consumed in the air box, and combustion conditions in the cylinder will improve correspondingly.

On four-stroke unsupercharged engines these flame heaters have not been very successful. Oscillograms of starter currents indicate that sometimes a few weak explosions in the cylinders will be followed by a non-firing period. This would indicate a lack of sufficient oxygen in the cylinder at the moment of fuel injection to initiate combustion, and a possible solution of the problem would seem to be to crank the engine for a short period with the burner going and then to suddenly cut off the fuel supply to the burner, depending on the increase in the oxygen content of the charge to effect ignition of the injected fuel. The installation of an air oil burner on a four-stroke engine is shown in the sketch of Fig. 8 from Mr. Pelizzoni's paper.

It is possible also to use an oil burner as a pre-heater, especially in connection with a two-stroke engine in which the cylinders are surrounded by an air box. The air flow is then produced by a small electric fan or blower, and the inlet to and outlet from the air box are so located that the gases of combustion follow a circuitous path and will give up a large percentage of their heat to the walls of the box. Finally, oil burners may be combined with heat exchangers connected across the cylinder cooling jackets. The heat imparted to the coolant in the heat exchanger will produce a thermo-siphon effect and cause the heated coolant to circulate through the jackets, thereby warming the cylinder walls. Here again, the same as in the case of electric immersion heaters, the starting conditions improve more slowly than where heat

is applied directly to the air on entering the cylinders. Mr. Pelizzoni made mention of one small unit of this type in which the rate of combustion can be adjusted to generate from 1200 to 6000 Btu per hr. This is equivalent to a range of 340 to 1700 watts with an electric immersion heater.

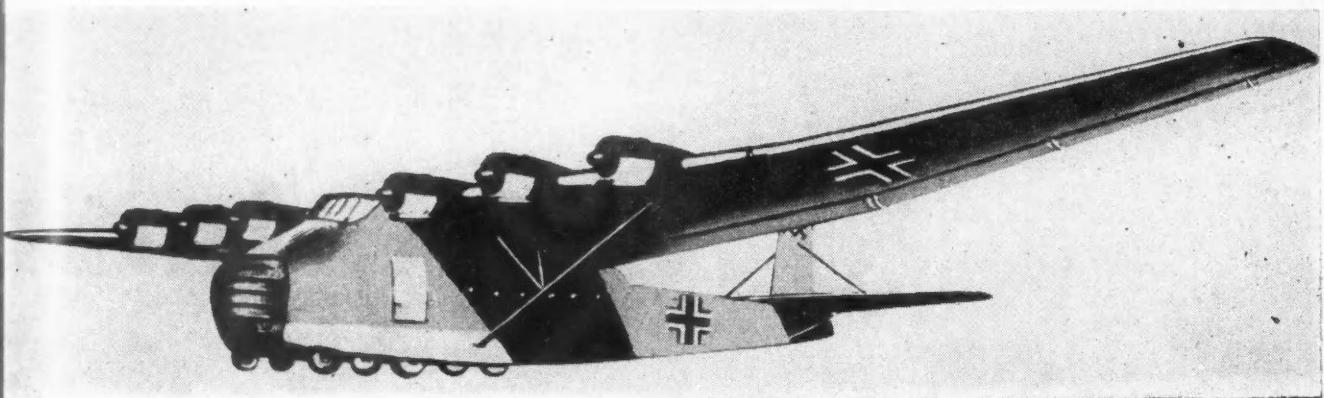
The principal starting aid for gasoline engines is the choke, which when closed supplies a large surplus of fuel to the cylinders. When the engine is very cold, only the more volatile fractions of the fuel will vaporize, and if the engine is choked there will be enough of these volatile fractions in the cylinder to form an ignitable mixture. The same general principle should be applicable in the case of Diesel engines. Diesel fuels consist of a mixture of hydrocarbons of different

ignition qualities. This was proven by tests made at The Pennsylvania State College by T. B. Hetzel, who fractionated a number of Diesel fuels and determined the cetane numbers of the fractions. As a rule, the cetane number increased with the distillation-temperature range of the fraction, and in the case of one particular fuel the cetane numbers ranged from 42 to 62. If an excess of fuel were injected, the actual amount of constituents of high ignition quality in the cylinder would be greater, and this might be expected to improve the chance of ignition under otherwise similar conditions.

Starting tests in which the injection quantity was varied have shown that starting is facilitated if the injection quantity is increased to nearly twice the normal full-load value. As the injection quantity is lowered, starting becomes more difficult. Ease of starting, as always, is measured by the length of time the engine must be cranked at any given ambient temperature to cause it to pick up its cycle.

Another factor connected with the injection equipment that has some influence on the ease of starting is the uniformity of fuel distribution or of injection. Since the injection quantity affects the ease of starting, it is obvious that the engine will start most readily if all of the cylinders get the optimum injection quantity, which is possible only if the fuel is distributed uniformly to all of the cylinders. Formerly most injection pumps had a stop on the quantity control rod which positively limited the maximum amount of fuel that could be injected to that required for full load. Now some pumps at least are provided with a so-called priming device which makes it possible to inject extra fuel for starting. Test results indicate that the optimum injection quantity for cold starting reduces the required cranking time about 25 per cent, as compared with the full-load injection quantity.

Control of the injection quantity for starting is particularly desirable for the reason that without special provisions the quantity of fuel injected for a given control-rod setting is smaller at cranking speeds than at normal operating speed.



Messerschmitt Me 323 transport monoplane, a so-called "powered glider" equipped with six 700-800 hp Gnome-Rhone engines.

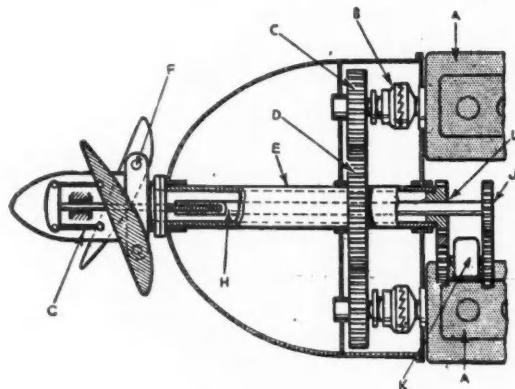
New German Warplanes

THE British Air Ministry has issued what are described as "provisional details" of three new types of German aircraft and confirmation of the existence of a Daimler-Benz dual engine.

Me 323 Transport Monoplane

Of the three aircraft referred to the most notable and unorthodox is the Messerschmitt Me 323. It has accommodation for about 130 troops, the disposable load being approximately 22,000 lb. Said to be the latest and largest of the so-called "powered gliders," it might be better described as a transport monoplane of high power loading. With its six French Gnome-Rhone 14-cylinder radial engines, each of 700-800 hp at 10,000 ft, it is believed to be fully capable of maintaining itself in flight independently of the pilot's ability to operate it as a glider. (Reports from North Africa state that the Germans were using Me 323 planes to transport troops and fuel from Europe to Tunisia. The Me 323 is reported to have a wing span of 180 ft, a maximum speed of 160 mph and a range of 450 miles. Ed.)

As shown in the accompanying wash drawing, prepared by the Air Ministry in England, the six engines are arranged along the leading edge of the wing, which is strut-braced to the deep fuselage. Forward of the leading edge is the pilot's cockpit, while built into the front end of the fuselage is a multi-wheeled

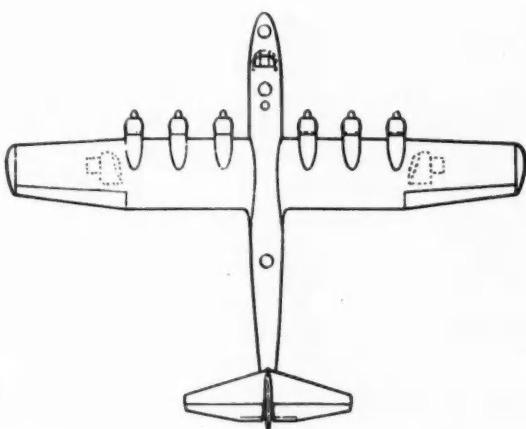


Daimler-Benz method of coupling two engines to a propeller (Sketch reproduced by courtesy of Flight, London.)

(10 wheels) undercarriage intended to allow a landing to be made on rough ground.

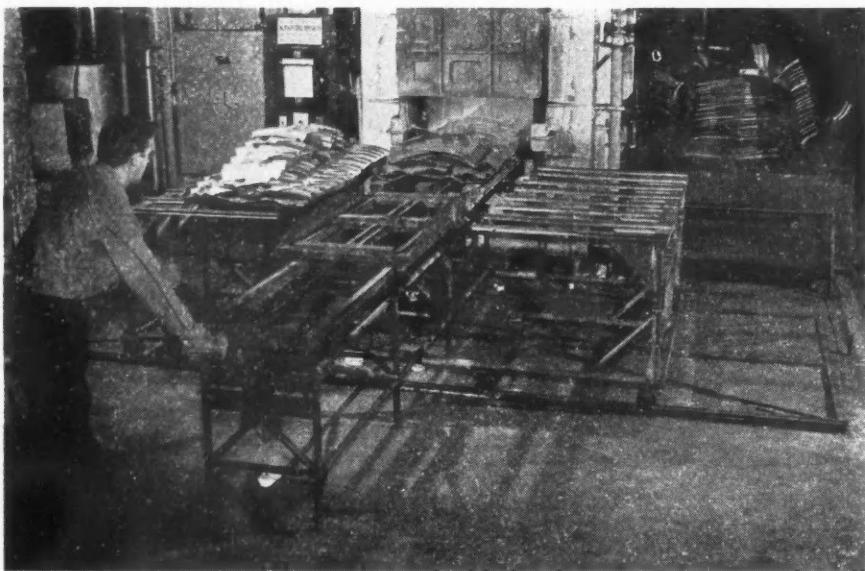
High-Altitude Ju 86

The second new German aircraft is the high-altitude Junkers Ju 86, a specialized high-flying machine developed from the old Ju 86 medium-altitude bomber. One sub-type is designated (Turn to page 82, please)



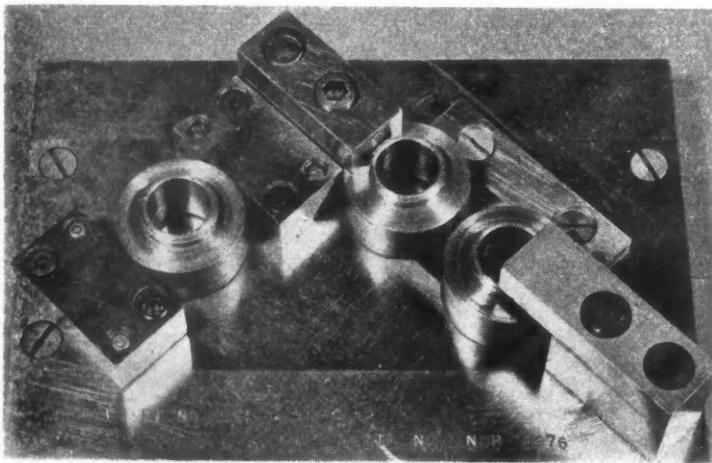
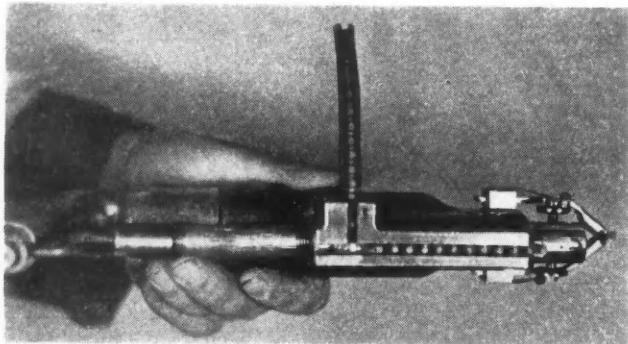
General arrangement of Blohm and Voss BV 222 50-ton flying boat originally designed for trans-Atlantic service, but now adapted to German military purposes.

Short



(Below) The Manufacturing Research Department of Vultee Aircraft, Inc., has developed this portable riveting tool with an automatic injector which inserts the rivet in the hole and performs the riveting operation without the tool being removed from the work. In addition to speeding up the work, the new tool eliminates loss of rivets, the need for sorting machines, gathering of fallen rivets from floors, and loss of time in sorting. Another advantage is that it leaves the operator's hands free to perform the riveting operation. By combining the unit with another device developed by the Vultee Field Division, known as the Vultee riveting yoke, complete riveting operations can be carried out by one person. The automatic injector is designed to fit any standard riveting gun.

(Top left) At the Ryan aircraft plant in California six heavy steel loading trays were being worn out each day due to the friction in dragging the white hot trays when loading and unloading the heat-treat furnace. By installing a movable loading fork as shown in the photograph, a single tray now lasts a full day and the time needed to load and unload the furnace has been cut in half. The saving in steel amounts to about 365 lb. per day. On each side of the loading fork, which is operated by a crank and chain, is a section of a movable table that is used in conjunction with the loading fork.



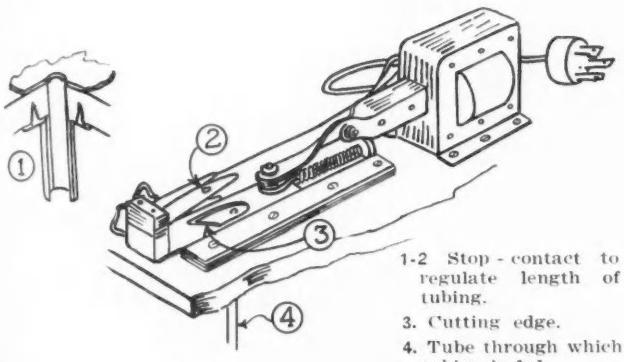
(Above) This three-in-one gage for inspecting bearing cups increased production on this operation 85 per cent at Fisher Body's Ternstedt manufacturing plant in Detroit. Under the old method 290 pieces could be checked in an hour using three separate gages; now 538 pieces are inspected per hour. By fastening the three gages permanently to a plate, this setup eliminates holding gages or part during the inspection operation.

(Below) This jig for bending filler ends on straps used on the Boeing nacelle was devised by Ralph Froelich of Northrop Aircraft, Inc. This part was to be made on the brake, but since the parts vary in size, they cannot be made accurately on the brake. It takes approximately three minutes to make the part on the brake, while with the jig illustrated as many as 200 can be made per hour.



Cuts

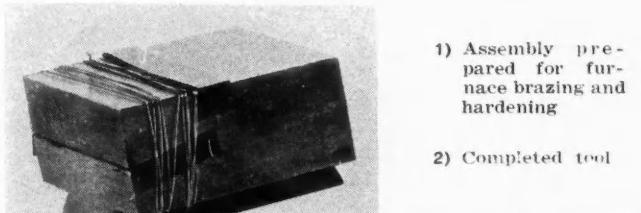
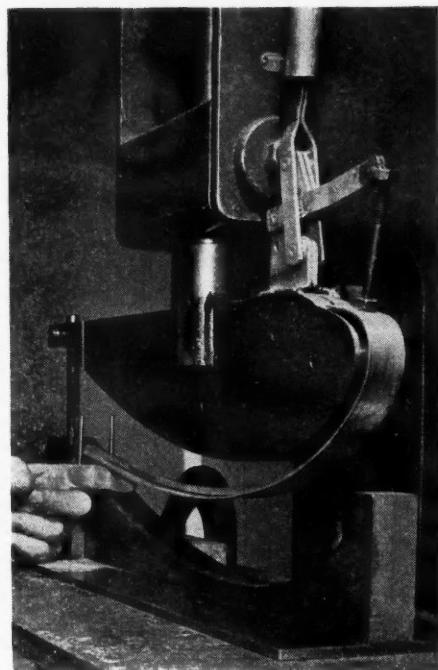
(Below) A device for quickly cutting rubber tubing accurately to length has been submitted to the War Production Drive Committee by Sam D. Carter of Northrop Aircraft, Inc. It is an electrically-operated device and is made in the form of a small box containing a solenoid with a plunger to which a cutting blade is secured. When the rubber tubing is fed into the box it operates a contractor which controls the solenoid. The blade cuts the tubing as soon as the contractor is closed by the pressure of the tubing.



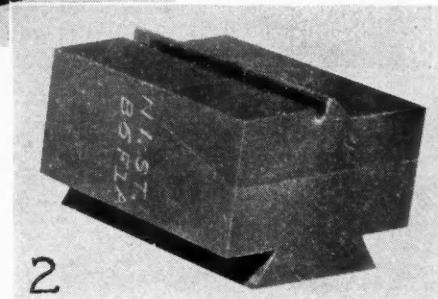
(Center right) To save critical high-speed steel, at the Schenectady Works of General Electric Co. tools are now being tipped with such steel by furnace brazing and hardened at the same time. First the tool blank is rough-machined, and the part which has to be tipped is ground. The high-speed steel tip is then ground to match the contour of the blank, to ensure all-over contact. The tip is then nickel-plated, and a 0.005 in. copper shim is then inserted between the shank and tip, the parts being held together with chrome-nickel wire. Both tip and shank are then covered with a suitable flux, to prepare them for brazing and hardening, which is done in a "controlled-atmosphere" electric furnace using drycolene, a gas developed for use in heat-treating furnaces. The tool is kept in the furnace long enough to raise it to 2375 F (2250 if it is made of molybdenum steel). After careful removal from the furnace so as not to disturb the tip, it is quenched in oil until it turns black, approximately 1100 F, and is then cooled in still air.

(Above) A simplified method of machining the inside surfaces of a hollow-shank stub pinion has been worked out by George Smolarek of Packard Motor Car Company's Aircraft Engine Division. A sectional view of the stub pinion is shown in the drawing. Originally, sections E and A were drilled out to $39/64$ in., section B to $31/64$ in. and section C to $27/64$ in., drills of the sizes mentioned being used. Section D was drilled in a previous operation. Sections E and A were then reamed out to $5/8$ in. so as to accurately center the roller pilot for the counter-boring operation in sec-

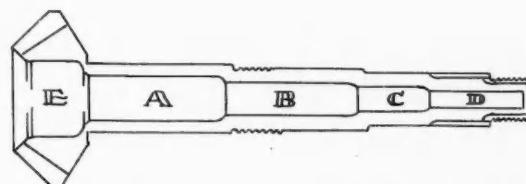
(Right) A reset die for an anti-drag long-T stiffener has been devised by H. Embry of Northrop Aircraft, Inc., and is shown by the photograph. These parts are heat-treated and they straighten out or distort while receiving the treatment, for which reason they had to be hand-finished to fit a template, which required 3 minutes on the average. The parts after heat treatment are now being passed through the reset dies shown. It is still necessary to check them with the template, owing to variations in the stock, but about 40 per cent require no work at all, while the remainder require only little hand finishing. Before the dies were being used, one person could check from 125 to 150 parts per day; now from 600 to 700 parts are being checked per day.



1) Assembly prepared for furnace brazing and hardening



2) Completed tool



tion E by the rough and finish reaming tools. Next sections A, B and C were finish-reamed with a step reamer. As the six tools used for previous operations occupied all of the stations on the turret, it was necessary to perform this last reaming operation on another machine. By the new method $5/8$ -in., $1/2$ -in. and $7/16$ -in. drills are used for the three drilling operations and the first reaming of sections E and A was omitted. It was found that the holes could be drilled sufficiently accurately to meet requirements, and this provided a station on the turret for the step reamer.

Construction and Equipment of the

Focke-Wulf FW190A-3

By M. W. Bourdon

Special Correspondent of
AUTOMOTIVE and AVIATION
INDUSTRIES in Great Britain



Cockpit cover. The rear sliding portion consists mainly of a single sheet of molded transparent material. This part of the cover can be jettisoned in emergency by a cartridge that breaks the guide.

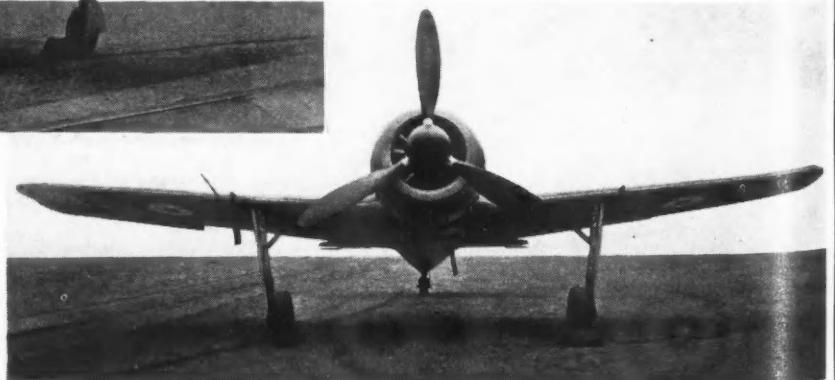


Focke-Wulf FW 190A3 fighter used by the British for investigation of its performance and construction.

A GREAT deal of information additional to that released in England towards the end of last summer, and published in these pages on Sept. 15 and Nov. 15 last, has been given recently in a preliminary report issued by the British Ministry of Aircraft Production regarding the Focke Wulf FW 190A-3 fighter aircraft, Germany's latest machine of this type to be put into service and one which authoritative opinion agrees is the best combat machine yet put into the hands of the Luftwaffe. It can be adapted for use as a fighter-bomber, for there is provision for a bomb carrier under the fuselage. Fuel and air pipes indicate that a jettisonable fuel tank could be carried as an alternative on the bomb rack.

The machine is powered with a BMW 801D 14-cylinder twin-row radial engine with direct-injection of the fuel and developing about 1600 hp. Details of a very similar engine, the BMW 801A 14-cylinder radial, were described and illustrated in AUTOMOTIVE AND AVIATION INDUSTRIES of Oct. 15 and Nov. 1 last. The installation is peculiarly compact and is contained in a cowling of only 51 in. diameter. The two-speed supercharger operates with

automatic control by a master unit that also regulates propeller pitch, mixture strength, magneto timing and throttle position. A VDM three-bladed propeller is used, and while its diameter of 129 in. appears small for the power available, it has a fairly high solidity



Part One

3 Fighter

of 0.13. Hand and automatic pitch control are provided.

The degree of electrification of the aircraft as a whole is high, hydraulics being used only in the propeller constant speed mechanism and in the brake system. The electrical system, with a 24-volt 2 KW generator, has a distinctive feature in that it includes a 24-volt 10 amp-hr alkaline battery in lieu of the lead-acid variety. Among other features of note are the use of the tubular mounting ring of the engine to form a reservoir for the hydraulic fluid, unconventional wing construction and effective provision for CO elimination from the cockpit.

Wing, Flaps and Fuselage Construction

Assembled as a unit, the wing has a continuous single spar through the fuselage and is attached to the latter at five points. Two vertical bolts pass through attachments at the top of the main spar, two horizontal pins at the roots of the light trailing edge member (which is not continuous) and one further horizontal pin joint at the center of the main spar bottom boom. This latter connection is made to support the bottom spar boom laterally, as the bottom central engine-mounting tube is connected at this point to the front side of the spar boom.

The main spar is a built-up I-section member of substantial construction in the center section, but with rapidly tapering top and bottom booms, while the web is a solid plate of the same thickness throughout its length. Thus it appears that bending stress is taken entirely by the main spar near the center section, while farther out, when the spar flanges become of negligible size, it is shared by the many L-section stringers. Throughout the wing, shear is taken by the main spar and trailing edge member, which has a solid plate web. The ribs consist of plate webs with their edges turned over to form flanges riveted to the skin. These rib flanges are cut away to clear the stringers and the webs are pierced with lightening holes with turned-over edges for stiffening. The main spar and trailing edge members form a torsion box with the top and bottom wing skin.

Each split flap is made from three pressings riveted together with upturned edges so that the leading edge forms a box. The flaps are operated electrically by a screw jack. A notice in the cockpit states that the flaps are not to be lowered at speeds in excess of 295 km/hr. (185 mph).

The stressed skin fuselage has 21 L-section stringers with one wide top-hat-section stringer at the top.



Tail wheel retraction mechanism housed within the rear part of the fin and made accessible by opening the hinged panel as shown here.

L-section transverse formers are used, about 18 in. apart. There are two self-sealing fuel tanks of the fiber shell type in the lower part of the front fuselage. One is of 292 liters (64 Imp gal.) and the other of 232 liters (51 Imp gal.) capacity. The pilot's seat is adjustable for height and its back is formed of steel plate, 8 mm. thick.

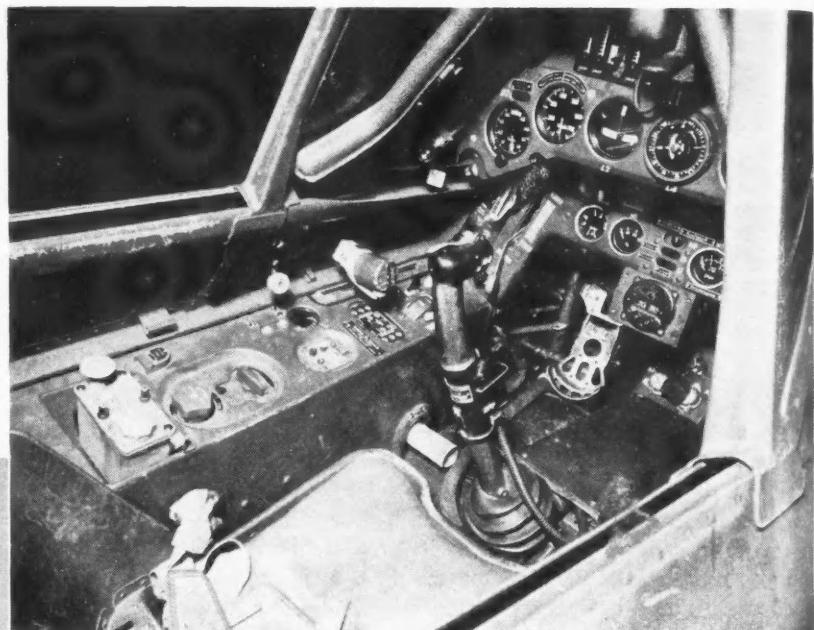
Tail Unit

The tailplane is in one piece. The center section consists of a large tube passing through the fuselage. The metal skin is riveted to the flanges of the ribs and spanwise members, all of which consist of plates with their edges turned over. The leading edge consists of a thick half-round section and the tip is formed of a single pressing. Both are attached by screws with Simmonds type anchor nuts. The fin is of similar construction, except towards its rear edge, where the tail wheel retraction mechanism is housed. In this part of the fin there are no ribs, but the skin is double, the inner skin being dished and riveted to the outer skin at the center of each dishing (see accompanying photograph). The bottom rib is of full width and carries the main rudder bearing at its rear end.

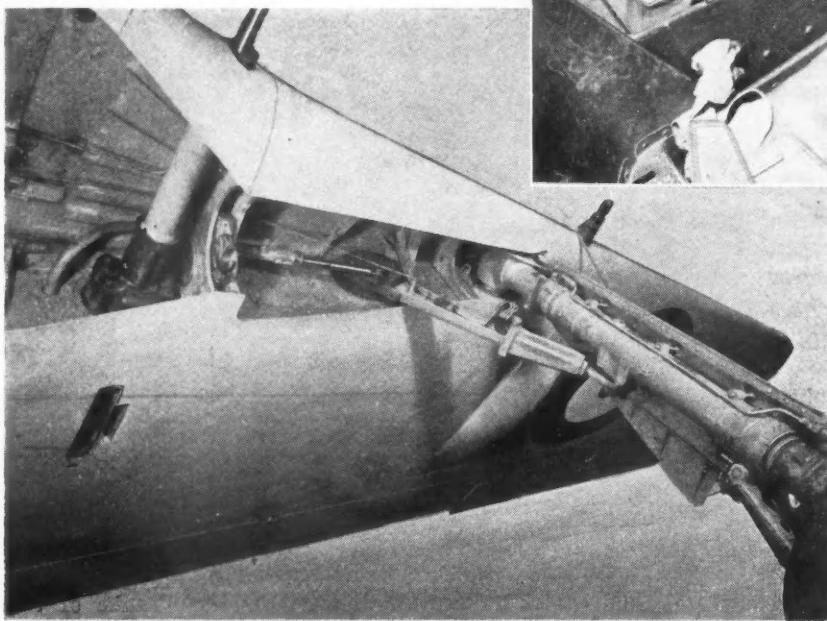
Aerodynamic Features

Control surfaces are fabric-covered aft of their hinges and have rigid metal noses. The halves of the elevator are bolted together through flanges on the leading edge tube.

(Right) Port side of cockpit.



(Below) Looking up at the main undercarriage, port side.



WING—The low wing has a span of 34.5 ft., a mean chord of 5.95 ft. and a tip chord of 4.05 ft. The mean thickness/chord is 12 per cent and at the root it is 14 per cent. The taper ratio is 1.84 and the dihedral is 5 deg. The section is quite conventional with the maximum thickness at 25-30 per cent chord. Wings tip are fairly square and wing root fillets quite small.

FLAPS—Electrically-operated split flaps are provided with indicators in the cockpit and on the upper wing surface. The flap span is 7.9 ft. per side, with a cutaway at the center. Maximum angle of depression is 60 deg.

CONTROL SURFACES—The ailerons are of the Frise type, chord 18 in., hinge 5½ in. behind leading edge and span 7 ft. 3 in. per side. They are fabric covered aft of the hinge, but have rigid metal noses. Elevator and rudder are balanced by shielded horns. There is no sealing of the gaps and no detachable hollow grinding.

The elevator controls are operated by steel wires. All other controls are operated by pushrods.

TRIMMING—None of the control surfaces has trimming tabs adjustable in flight. They have fixed

tabs, pre-set on the ground, about 12 in. x 1 in., perforated with small holes to facilitate bending. The whole of the tailplane is adjustable about its spar over an incidence range of from -3 deg to +5 deg. When first viewed it was at +1 deg. It is electrically operated by means of two push-buttons with the indicator at the pilot's left hand behind the throttle lever.

A notice in the cockpit states that the under-carriage must not be lowered at speeds below 200 km/hr. (125 mph). This is probably because of the change of trim, which might be dangerous at very low speeds.

Undercarriage and Tail Wheel Unit

The undercarriage is high and has a very wide wheel track. Each wheel is mounted at the end of a single long oleo leg with a concertina cover and triangular torsion links. The oleo legs have a possible travel of nearly 15 in. Each one is hinged at the top on a shaft with bearings in the light leading edge member (which is not secured to the fuselage) and in the main spar. Wheel and leg fold inwards into a recess in the underside of the wing as the hinged stay breaks, and is folded by an electric motor with a worm and pinion drive. The well under each wing is closed by fairing attached to the outside of each leg and by a door that is opened and then closed by a system of cables attached to moving parts of the undercarriage. The front tires are 700x175 mm. with 4 ata (56.8 psi) working pressure. Hydraulic wheel brakes are operated by pressing a rubber pedal.

With a 350x135 mm. tire (working pressure 4.5

(Turn to page 64, please)

Buick Method for Steel Cartridge Cases

ONE of the major contributions of the automotive industry to the war effort is the development of a special technique for the production of steel cartridge cases by the Buick Motor Division of the General Motors Corp. The Buick process stems from the cooperative efforts of Buick metallurgists and metal-working executives with the Army Ordnance Steel Shell Case Committee. It is one of several processes developed under the direction of the Ordnance Committee and is employed by Buick in the manufacture of 75 mm cartridge cases and by several other companies for smaller sizes. Major operations as performed at the Buick plant are listed in the accompanying table. An open hearth, high manganese, aluminum killed, fine grained carbon steel was found to be the most satisfactory for the cases and is now in production.

R. B. Schenck, Buick's chief metallurgist, states that the most interesting step is the four cold drawing operations on a single 750-ton Clearing double acting press. The four punch and die stations are placed to form the four corners

of a rectangle well within the normal platen area, and are so arranged as to carry approximately an equal load of about 150 tons per station. The depth of the

draw varies slightly over the four dies, the length of the punch controlling it. Four operators handle the press, one at each die. Each punch has an integral mechanical stripper which removes the part after drawing. On this press the six-inch cup is drawn to 15 in. and to the approximate form of the finished case, a total draw of 9 in. with no substantial change in diameter.

Previous to these cold drawing operations the cup is Bonderized to clean the surface thoroughly and to etch it slightly so that the drawing compound will be retained in the pockets. The thin surface layer of zinc phosphate deposited by this chemical treatment also acts as a lubricant during the cold drawing. Since hydrogen embrittlement resulting from acid pickling

and Bonderizing tends to cause breakage during cold drawing, this condition is eliminated by annealing which drives off absorbed hydrogen.

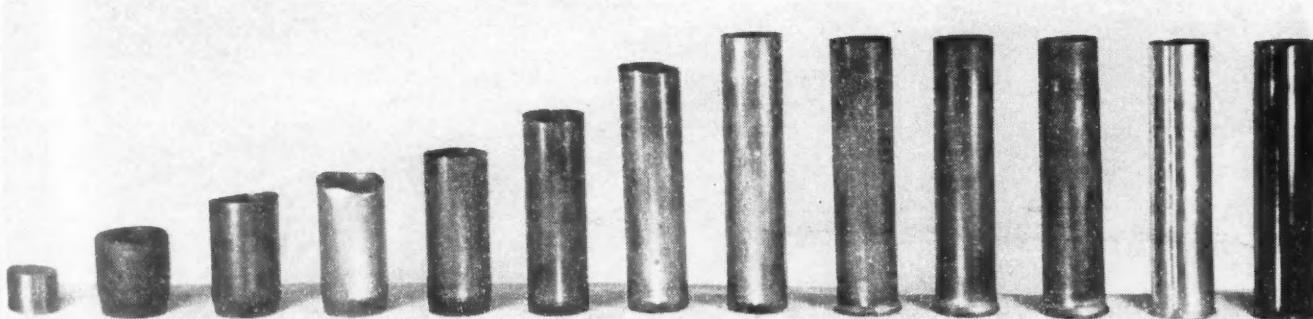
Annealing is necessary before tapering to prevent splits during the lat-

(Turn to page
86, please)

Major Operations at Buick Plant for Manufacturing 75 MM. Steel Cartridge Cases

1. Cut off 1 $\frac{3}{4}$ in. blank (3 $\frac{1}{8}$ in. OD)
2. Grind OD on Cincinnati Centerless, followed by Magnaflux inspection
3. Heat in special Tocco induction unit
4. Extrude to 4 in. in standard forging press of crank type
5. Redraw hot to 6 in.
6. Size cold, drawing slightly
7. Anneal
8. Pickle and rinse
9. Coin head in Toledo crank press
10. Bonderize
11. Anneal
12. Trim end
- 13, 14, 15, 17. Cold redraw to 15 in.
16. Trim end
18. Bonderize
19. Cold head in press equipped with two-stage indexing die
20. Flame anneal
21. 1st taper
22. 2nd taper
23. Flame anneal
24. Machine base
25. Face to length
26. Finish ream and counterbore
27. Inspect and repair
28. Stress relief in electric furnace
29. Phosphoric acid pickle
30. Spray inside and outside with unpigmented phenolic varnish
31. Bake for 48 minutes at 360 F between banks of infra-red lamps

Various stages in the formation of Buick's 75 mm. steel cartridge case, starting with the blank at the extreme left.

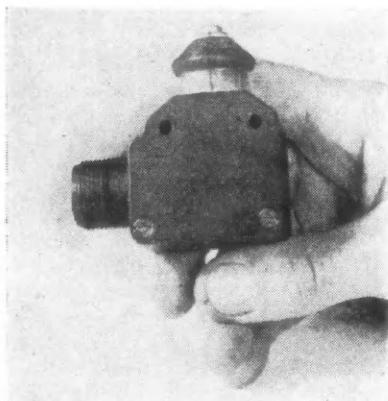


New Products for Aircraft

Lightweight Limit Switch for Aircraft Applications

A lightweight, dust-tight limit switch for aircraft applications where space is limited, has been brought out by the General Electric Company, Schenectady, N. Y. This small switch has a contact mechanism of the snap-action, double-break type which gives it a high current rating and makes it desirable for applications where severe vibration conditions are encountered.

The new switch is a spring-return, plunger-operated type with a 7/32-inch



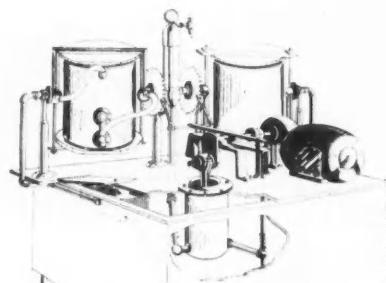
General Electric Lightweight Limit Switch

overtravel. It can be mounted either on the cover side or on the opposite side, thus facilitating the operation of the plunger from either the right or the left.

The switch is available in three different contact arrangements; single-circuit, normally open; single-circuit, normally closed; and two-circuit, normally open and normally closed. It is also furnished with either die-cast zinc or die-cast aluminum housings and with either solder lug connections or, in the single-circuit forms, with an AN connector insert built in the AN threaded nipple of the housings. In addition, the switch is available with a rubber boot mounted over the plunger-operating mechanism for use in locations where mud and sand are encountered.

Turco Washer for Oil Temperature Regulators

Specially developed for thorough cleaning of aircraft oil temperature regulators, the Turco Surge Washer, has just been placed on the market by Turco Products, Inc., Los Angeles, Cal.



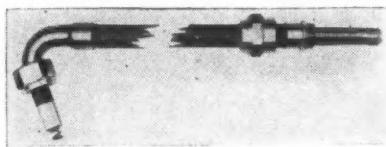
Turco Surge Washer

The machine operates by a cleaning solution pumping mechanism so designed that a reversal of flow is obtained many times every minute. The pump produces a surging action which pushes and sucks the cleaning solution through the interiors while the regulators are constantly being turned and tumbled. This motion dislodges the sand, heavy metal particles and other insoluble materials which then are carried out by the current.

Turco Penetrol is the solution in the machine which removes surface soil in the radiators, emulsifying oily and greasy deposits and deflocculating carbon. The mechanical forces of the Turco Surge Washer, combined with the cleaning properties of Turco Penetrol, insure thoroughly cleaned units, according to the manufacturers.

Ignition Lead for Aircraft Engines

The Unimold Ignition Lead for aircraft engines, which is part of the complete radio shielded ignition harness manufactured by the Titeflex Metal Hose Co., Newark, N. J., is instantly detachable, and incorporates the feature of being integrally molded. The conductor is molded integrally with the two end connections, and the inside of the tubing and end connections is filled with an homogeneous, high dielectric,



ozone-proof material. This construction avoids the use of a number of loose parts, and provides a lead which is capable of withstanding the mechanical and electrical abuses experienced on airplane installations.

Locking System for Studs and Inserts

The "Rosán Locking System" employs a ring, serrated inside and out, to prevent the loosening of studs and threaded inserts. In practice, the stud is installed by customary methods, and the serrated ring forced into place over interlocking serrations built into the stud head, making a tight fit flush with the surface of the material in which it



Rosán Locking System for Threaded Inserts

is used. The threaded insert developed by Rosán is locked in place by means of the same interchangeable serrated ring. Rosán Locking System rings, studs and inserts are being manufactured under license by Bardwell and McAllister, Hollywood, Cal. It is said that both the stud and insert have been found to possess many applications to aircraft and engines, and to have solved a number of operational and service problems.

(Turn to page 74, please)

INLAND STEEL

TODAY-for men who fight
TOMORROW-for men who build



INLAND STEEL CO.
CHICAGO

SHEETS • STRIP • TIN PLATE • BARS • PLATES • GROUPS
STRUCTURAL • PILING • RAILS • TRACK ACCESSORIES • BRASS FURNISHINGS

New Production Equipment

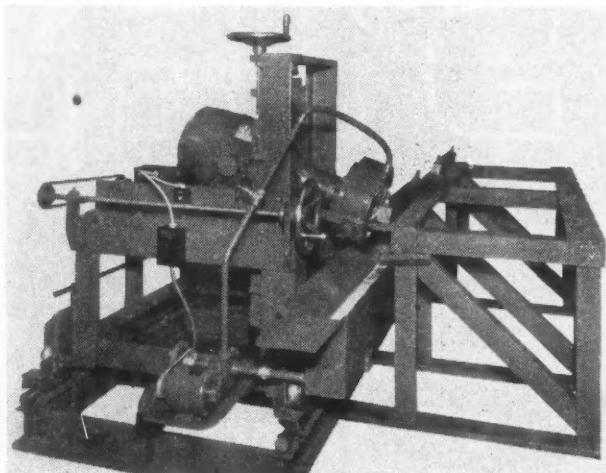
THE GRC Type Vonnegut Armor Plate Grinder was originated by the Vonnegut Moulder Corporation, Indianapolis, Ind., as a quick solution to the problem of grinding straight-line, square and beveled ends and edges of certain hardened armor plate patterns. However, the type of design, particularly the fact that it is constructed almost entirely of welded structural steel sections, permits changes in dimensional specifications without necessity of long delay for new patterns.

The grinding unit has 90 deg. angular adjustment, 45 deg. below and 45 deg. above horizontal, with vertical and horizontal adjustment to compensate for angular setting. The angularity is indicated on a quadrant scale. Each of the three adjustments is made with its respective hand-operated screw. Angular and vertical positions are secured with locking clamps and end adjustment of the motor unit is held to position through spring pressure friction to permit continuous feeding of wheel into the work.

The frame of the grinding unit is supported upon four grooved wheels which roll upon a pair of round steel tracks mounted upon a pair of I beams.

The grinding unit is drawn back and forth along the track by a power feed reversing cable drive. The cable drum is driven by a 1/2-hp motor. The length of travel is controlled by contact of the grinding unit with adjustable throw collars upon a shifting rod extending the length of the tracks. Three standard rates of feed are 4 ft, 6 1/2 ft and

The Vonnegut Armor Plate Grinder



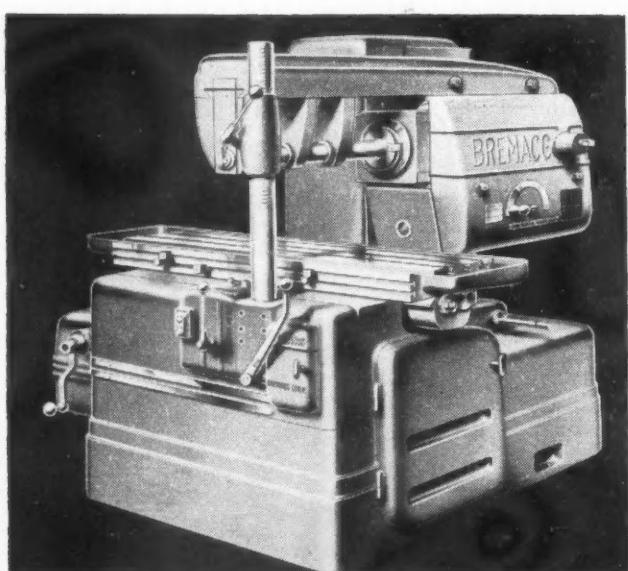
8 ft per minute but three alternate rates of feed may be specified. A coolant tank and pump with 1/4-hp motor are attached to and travel with the grinding unit. The grinding and feed motors are controlled through push buttons and magnetic contactors with thermal overload relays and undervoltage release.

The machine is available with a 10 in. diameter segmental abrasive chuck driven by a 7 1/2 hp 1800 rpm motor, or a 14-in. chuck driven by a 10 hp 1200 rpm motor.

THE Bremacc Corporation, Detroit, Mich., is introducing a Model No. 4 milling machine with twin lead screws. The two unsplined lead screws are so connected in relation to each other that the effective bearing surface is constantly in tension with the feed nut through the use of a synchronizer sleeve arranged outside the gear housing in the table. Axial play in the thread shoulders of the lead screw is said to be eliminated, whether the table moves with or against the cutter in heavy feed or rapid traverse.

The table feeds range from 1/2 in. to 30 in. per minute. Rapid traverse has a standard table speed of 125 in. per minute. Both table feeds and rapid traverse can be operated manually or automatically in either direction.

The main gear box has two speeds, which, together with pick-off gears, provide semi-quick change of the spindle speed. Power is supplied by a 10 hp. motor. Complete control equipment is mounted in an enclosed cover on the left side of the machine.

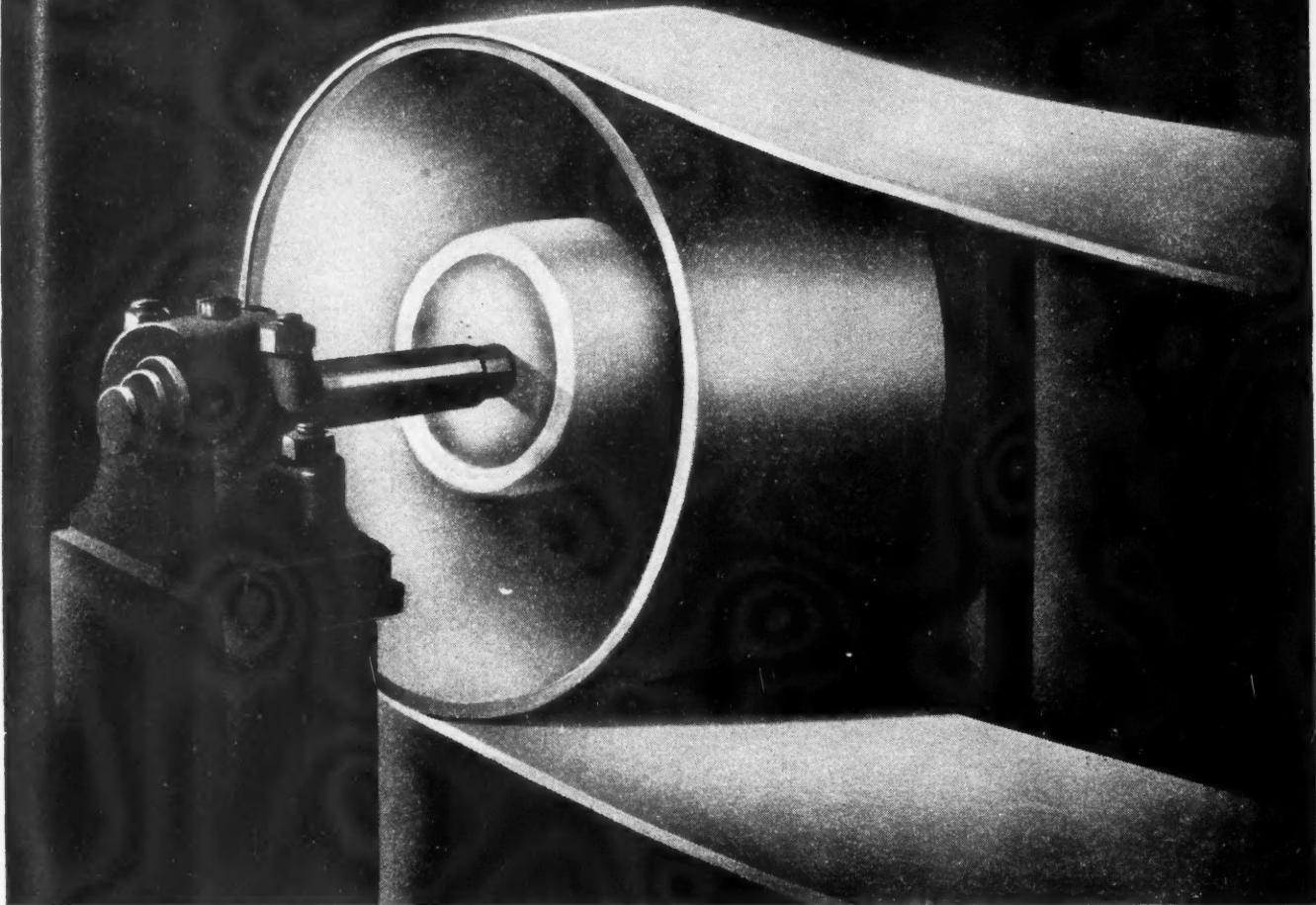


Bremacc No. 4 Milling Machine

AN IMPROVED coil-turn counter for laboratory or factory use in determining the number of turns in wound electric coils has been brought out by the General Electric Company, Schenectady, N. Y. Employing the same circuit as its predecessor, the new counter is more compact in design and incorporates a magnetizing cur-

(Turn to page 88, please)

Overload—and failure!



Information supplied by an Industrial Publication

Recent tests by a well-known rubber company prove that as little as three pounds extra tension on power transmission belting, above recommended tension, will shorten its life as much as 68 percent!

In the tests three grades of the present wartime construction of transmission belting were used. Each belt was run at 15 pounds per inch per ply, a 720 pound total for the tension, the recommended figure, and at 18 pounds per inch per ply, a total of 864 pounds tension, on 4 inch diameter pulleys. Belts were all 6 inches wide, 30 feet long, spliced in 10 foot endless lengths. Tests were all highly accelerated.

Belt No. 1 ran for 95 hours before breakdown under the 19 pound tension, and increased its life to 230 hours before failure when the tension was 15 pounds.

Belt No. 2 ran for 88 hours at the 18 pound tension, and for 263 hours before failure at 15 pounds.

Belt No. 3 ran for 15 hours under 18 pound tension, and the service life before failure jumped to 48 hours under the 15 pound tension.

Close attention to "details" like this will save costly shut-downs and increase productive man-hours. This is just another case of designing to meet requirements — another important conservation measure.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.



MOLYBDIC OXIDE, BRIQUETTED OR CANNED •
FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City



In production of this kind the band saw is six times as fast as a slitting saw.

contour sawing of the radii of the contour always determine the width of the saw, and the widest saw possible should always be given the preference.

The recommendations made in the accompanying table should be of material help in increasing both the life of the saws and the cutting rate. These data are based on about 100 tests. It seems that the highest cutting rate was obtained in sawing through stock of 3½ to 4 in. thickness, with a work pressure of 75 lb. With such a pressure the cutting rate reaches about 2 sq. in. per min.

The largest aircraft plant on the

ing saws, the cost of resharpening the wood saws, and the difference in the first cost of the bands (50 cents), all of which items were in favor of the hardened saw, the firm figured it effected a saving of \$9000 during a year of 6240 hours (two shifts). But the real saving in this case results from the fact that if wood saws are used only for sawing wood in this plant, the annual outlay for such saws will be reduced from \$60,000 to \$20,000.

The band sawing

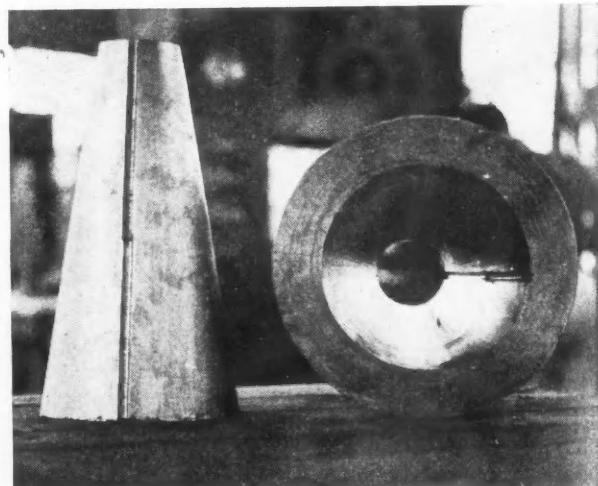
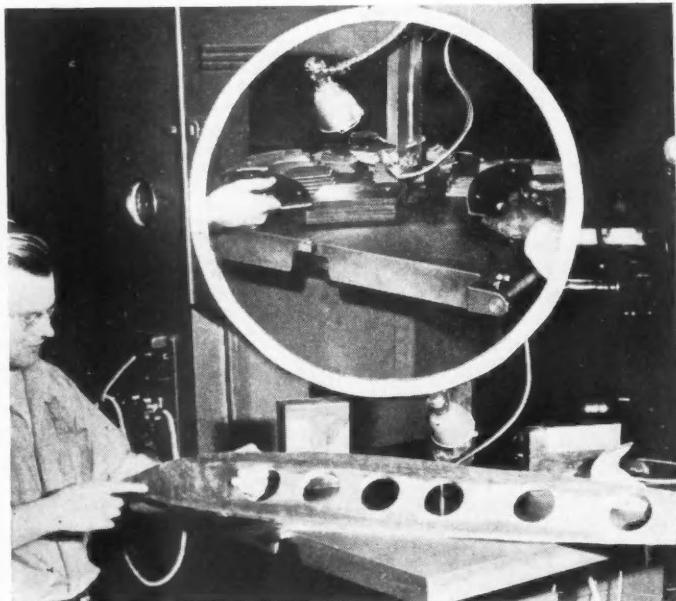
Improved Band Saws

(Continued from page 23)

West Coast recently substituted correctly-hardened for wood-cutting band saws in sawing Masonite. This firm had employed three band sawing machines equipped with wood saws on Masonite. This hard material quickly dulls the unhardened saws, and the life of the latter was about one hour. It was found that hardened saws in the same work lasted about ten hours. Taking account of the man-hours lost in changing

of resilient materials, such as sponge rubber, is one of the most recent developments. Such material can be sawed only with a band finished to a knife edge, a saw $\frac{3}{8}$ -in. wide, of 12-pitch, being used. The back of the blade must be fitted with some kind of drag eliminator guard to spread the material as the cutting proceeds. This guard must be accurately aligned with and fitted to parts of the saw guide.

The band is sharpened as above described by mounting an electric motor of about 1/6 hp on the table. The grinding wheel should be of J grade, 60 grain, and $\frac{1}{2}$ in. wide, and its diameter should be such as to give it a suitable surface speed. Another procedure which gives fairly good results and does away with the knife-edge scheme, consists in operating a 5/16-in. 14-pitch saw turned "inside out." In other words, the hook of the teeth is turned up from the work. This method also calls for a drag eliminator. No coolant is used with either procedure.



(Above) The slug shown at the left was removed intact from the 9½ by 7-in. heat-treated billet shown at the right. A $\frac{1}{4}$ -in. hole was drilled from both ends, at an angle of 9 deg. to the axis of the billet, to start the saw. As compared with boring, 5 hours time was saved and no material was wasted.

(Left) Duralumin aircraft part entirely contour-machined. Insert shows contour sawing short-run production stampings to save cost of dies.

Flexible at Extreme Temperatures!

In the sub-zero cold of the stratosphere . . . often dropping to 70 or 80 degrees below zero . . . Permatex Aviation Form-A-Gasket does not become hard, crack or fly to pieces.

In the high temperatures of the desert . . . often reaching 140 or 150 degrees above zero . . . Permatex Aviation Form-A-Gasket does not melt or run.

Permatex Aviation Form-A-Gasket is a heavy liquid that flows smoothly from the brush and is easy to apply. It produces a non-drying, flexible seal that is leak-proof to fuels, lubricants and other liquids used in internal combustion engines. It disassembles very readily.

Used in the machines of war and in the machines of peace!



PERMATEX COMPANY, INC. Sheepshead Bay, N. Y., U. S. A.

NEWS OF THE INDUSTRY

Production Speeded by Improved Methods and Simplified Designs

Automotive Plants Helped to Boost Military Airplane Production to 6200 Planes in March

Aerial torpedoes, previously made only in naval torpedo stations, are being manufactured successfully by two automotive companies, Pontiac Motor Division of General Motors and International Harvester Co. The aerial torpedo contains 5222 parts and 1225 different assemblies. Tolerances on some parts are held to 25 millionths of an inch and some are so small they must be lubricated with a medical hypodermic needle. Some of the precision work has to be done under a magnifying glass. International Harvester employed former watchmakers to instruct its employees in this fine work.

An aerial torpedo, which is nearly 20 feet long and weighs nearly a ton, consists of three sections: the "war head," which carries the explosive charge that blows up the enemy ship; the mid-section, carrying the air tank, water and fuel compartments; and the tail section, which houses the operating mechanism, including the gyro, the turbines and other parts that control the speed, direction and depth of the weapon in the water. The expansive force of compressed air, steam and gases from burning alcohol, fed into a turbine engine, provide the motive power for the two propellers, which turn in opposite directions to keep the torpedo on even keel and at the proper depth. These weapons are launched from low-flying Navy planes such as the Grumman Avenger and the Douglas Devastator.

Pontiac built a new plant containing nearly 500,000 sq. ft. for the manufacture of torpedoes. More than 1000 man-hours of labor go into each torpedo and the individual cost is equivalent to 10 or 12 medium-priced automobiles. Over 100 sub-contractors participate in the job.

Pontiac and International Harvester are among 1800 prime contractors and 25,000 sub-contractors turning out sea-going armament for the Navy. In addition there are 15 naval ordnance plants and 33 naval depots and magazines for storing ammunition. Both Hudson and Pontiac are making Oerlikon 20-mm. anti-aircraft cannon for the Navy, while Pontiac

also manufactures the Bofors 40-mm. gun.

Pontiac has cut the production time on parts for the Oerlikon 20-mm. gun by over 50 per cent. The breech case, which once took 190 hours for fabrication, now takes less than 65 hours. Time required for the barrel rifling operation has been cut 73 per cent. Pontiac automotive engineers redesigned the barrel spring casing, making it a hollow forged base to which a tubular steel extension can be welded. This starts with a rough forging weighing 14 pounds instead of the 56-pound alloy steel forging previously used. The latter had to be machined down to six pounds, with a resultant 50 pounds of critical steel scrap.

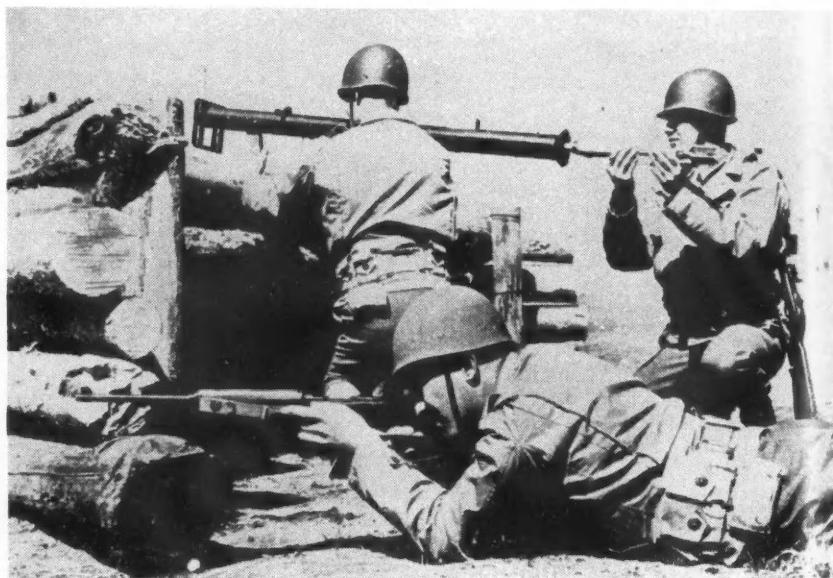
Use of a giant vertical chambering machine which accommodates 13 barrels at once has cut the time per barrel from 75 to four minutes. Rifling of the barrel has been reduced from 105 to 12 minutes. Trigger cover

plates previously were fabricated from a steel forging weighing nearly six pounds and had to go through 29 operations on a dozen machines. Now the trigger plate is made from a steel stamping, with a small part welded on, reducing the machine operations from 29 to 15 and saving two pounds of steel per piece. All these production short cuts have reduced the cost of 20-mm.

(Turn to page 60, please)

J. E. Fields Retires

K. T. Keller, president of Chrysler Corporation, has announced the retirement of Vice-President J. E. Fields, effective with the latter's sixty-fifth birthday, the retirement age for Chrysler officials. Mr. Fields, who has been an officer of the corporation since 1925 and a director since 1927 will continue to serve as a director, having been re-elected to the board at the last stockholders meeting. During his career in the automobile industry, Mr. Fields made many contributions to motor car merchandising, distribution, and service, and he is widely known personally to automobile dealers throughout the country. He will make his residence in St. Clair, Mich., where he operates a large farm and dairy.



The AT Rocket Launcher, M1

This recoil-free weapon, commonly called the "Bazooka," can be handled and operated by two foot soldiers. Its projectile, which travels at a comparatively low velocity, contains a very powerful explosive.



Rings of Iron *against* *Nazi and Jap!*

Behind the man behind the gun engines must function faithfully. For these engines Sealed Power is making piston rings, pistons, cylinder sleeves—making them precisely to the designers' specifications—24 hours a day—trying to make them worthy of the hard fighting soldiers, sailors and pilots who will depend on them for power. Wherever the United Nations fight you're sure to find Sealed Power engine parts in tanks, army trucks and jeeps, in pursuits, interceptors and bombers, in torpedo boats, destroyers and submarines.

SEALED POWER CORPORATION

Muskegon, Michigan • Windsor, Ontario



EVERY GUN,
TANK AND
SHIP IS HALF
SCRAP. SEND
YOUR SHOP
SCRAP TO
WAR.

PISTON RINGS—PISTONS—CYLINDER SLEEVES

Steel Prices May Be Forced Upward by 48-Hour Work Week

Claimant Agencies Said to Have Asked for About 43% More Steel Than the Output During the Third Quarter

By W. C. Hirsch

What recent developments add up to in the opinion of steel company executives, is that only early upward revision of base prices can prevent profitless operation. Steel consumers feel that, burning as the issue may have become through the setting up by the War Manpower Commission of the 48-hr week, entailing payment of time-and-a-half for hours in excess of 40, together with the effect on production costs of what has taken place at the coal mines, it is for WPB and OPA, and not for them, to safeguard the buyers' interest in this situation. In this connection it is interesting to note that in a recent report on the war metals program, made at President Roosevelt's request, WPB Chairman Donald M. Nelson observed that "in this war, money must be regarded as a means to an end, and not as a measure of the value of that end," adding,

however, that "so far as price to any particular producer is concerned, it is a governing principle that the price paid bears a reasonable relation to the costs of production and the earning of a fair return over the costs of each separate producer."

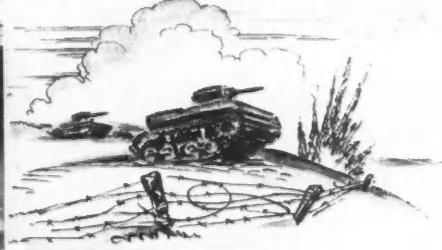
The steel market's history over the years shows that leading producers as well as representative consumers have striven at all times for stability rather than temporary advantages for either seller or buyer. And the record since the outbreak of the war has shown consistent adherence to this policy. Steel consumers are convinced that, unless the rise in costs blue-pencils the present price structure, producers will not ask for the authorization of advances, and that, when they do, they will be backed up by irrefutable facts and figures. It may, therefore, be expected that, if they become necessary, adjustments will be effected without causing

anything like the traditional squabbles in peace times when prices go up. Reports have it that claimant agencies have made demands for 20,000,000 tons of steel for the third quarter under CMP against a production of some 14,000,000 tons, necessitating numerous cutbacks in tonnage requests. There are still many nuts to crack in connection with CMP, but since it provides for definite shipments at a specified time, some of the army of expeditors are reported to have been recalled from the road. Steel men, in intimate touch with the scrap situation, say the supply is more reassuring, but that up to now there has been no marked homeward flow of battlefield scrap. WPB's Conservation Division is intensifying the drive for tool steel scrap, which contains highly critical alloying metals: tungsten, molybdenum, vanadium, chromium and cobalt.

Through granting to copper mines with less than 2000 tons output in 1942 a special premium, some properties, until now idle, have been encouraged to resume production, thus adding to the urgently needed supply of this metal. Tin tonnages, now arriving from the Belgian Congo, are reported to be running neck and neck with what we receive from Bolivia, a spectacular increase in the output of Katanga refined tin being noted. Bolivian tin comes to the United States in concentrate form and is smelted here, but the Congo product, a high grade tin, is smelted in Africa.

M-5 Light Tank

UNDER a contract awarded to it by the Cadillac Division of General Motors, the Southern California Division of the corporation is building M-5 light tanks for the Army Ordnance Dept. With the exception of the powerplant and transmission units, which are shipped there, practically all of the major items are made in the Los Angeles area. The tanks in the photo are nearing the end of the assembly plant at the Los Angeles plant.





Dual Rotation—*the dawn of a new air age!*

TOMORROW'S SUPER-SHIPS are in the making now. Ready for them is the Aeroprop Dual Rotation Propeller. Developed through seven years of intensive engineering, the Dual Rotation Aeroprop is now ready for mass production—for our fighting ships and for the new air age of tomorrow.

Two sets of Aeroproducts' hollow steel blades, rotating in opposite directions, harness the vastly increased horsepower of new aircraft engines. Thus, the Dual Rotation Aeroprop meets the demand for a propeller which absorbs greater horsepower... improves propeller efficiency... reduces propeller

sizes... and streamlines air-flow for greater speed, stability and safety.

In the swift rise of America's air supremacy, more powerful engines and improved propellers are an all-important team. This Dual Rotation propeller furnishes evidence that this progress will continue—that Aeroprops for tomorrow's planes will be ready.

AEROPRODUCTS DIVISION
GENERAL MOTORS
CORPORATION



BUY WAR BONDS — KEEP AMERICA FREE!

Unauthorized Work Stoppages Continue in Many War Plants

Employment of Negroes in Detroit's Major War Plants More Than Doubled During the Last Year

There have been more than 100 unauthorized work stoppages in Detroit area plants of the Ford Motor Co. in the last nine months. Nearly 30 of these wildcat strikes occurred in April and early May as labor troubles beset various departments of the Ford

Rouge and Highland Park plants. One strike cost 47,000 man-hours when 280 maintenance men in the production foundry at the Rouge failed to report due to a dispute over overtime pay on the swing shift, sending 5700 other workers home for lack of mate-

rial. Another series of work stoppages in the steel and aluminum foundries at the Rouge cost 56,136 man-hours of production and resulted in the firing of 141 employes, most of them Negroes. Officers of the UAW-CIO agreed to the discharges but said that only those cases where such discipline was unjustified would be taken up through the normal grievance procedure.

In a formal statement, the company blamed the trouble on a group of new Negro workers who have been employed in the last few months when manpower orders forced them to get into war plants or face induction into the Army. Of the 141 men fired, 127 were of draft age. A white foreman was killed by a Negro recently in a dispute in the steel foundry and there have been frequent stabbings and slippings. A scuffle between some Negro workers and plant protection men precipitated the latest series of work stoppages in the foundry. Union plant committeemen, many of them new workers, have shown themselves unable or unwilling to control their fellow union members. The situation has become so bad that Ford Local 600 of the UAW-CIO has appointed administrators to handle the affairs of the union departments in the aluminum and steel foundries. An earlier strike of 400 men in the magnesium foundry, mostly Negroes, was referred to the grievance procedure after the men refused to take orders and demanded the discharge of one foreman.

Ford probably employs more Negro labor than any company in the automotive industry, 15 per cent of the workers at the huge Rouge plant be-

(Turn to page 62, please)

A BLIND RIVET



FOR PRIMARY STRUCTURES

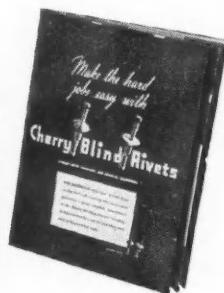
The Cherry Blind Rivet does its work very effectively by means of a mandrel passing through the rivet. A pulling force applied to this mandrel forms a head on the blind side and expands the rivet shank.

The self-plugging Cherry Rivet is used successfully in primary aircraft structures be-

cause the expanded rivet develops nearly the full unit strength of an equivalent joint employing a conventional solid rivet.

16-PAGE HANDBOOK, giving diagrams, dimensional sketches and photographs covering the Cherry Riveting Process, is available on request. Write for your copy today. Address Department 5, Cherry Rivet Company, Los Angeles, California.

CHERRY RIVETS, THEIR MANUFACTURE AND APPLICATION ARE COVERED BY U. S. PATENTS ISSUED AND PENDING.



NAWPC Elects LaMotte T. Cohu

LaMott T. Cohu, chairman of the Board of the Northrop Aircraft Corp., has been named president of the National Aircraft War Production Council to succeed Glenn L. Martin. He also has been named president of the West Coast Aircraft War Production Council and T. Claude Ryan, of the Ryan Aeronautical Co., is its new vice-president.

CALENDAR

Conventions and Meetings

- | | |
|--|-----------------|
| Nat'l Metal Trades Assoc. Production Conference, Chicago | May 26-27 |
| SAE Diesel Engine & Fuels & Lubricants Mtg., Cleveland..... | June 2 and 3 |
| SAE War Materiel Mtg., Detroit, | June 9 and 10 |
| Automotive Engine Rebuilders Assoc., Cincinnati | June 15-17 |
| SAE Nat'l Tractor Mtg., Milwaukee, | Sept. 23-24 |
| SAE Nat'l Aircraft Engineering & Production Mtg., Los Angeles, | Sept. 30-Oct. 2 |



AN ENTRY ON THE SERVICE RECORD

King-Seeley Corporation has always been an aggressive—yes, fighting—organization. Yesterday it was fighting for its share of business. Today, with a greatly-expanded capacity, it is still fighting—but fighting on the war production front. The Armed Services are receiving 98% of all goods produced.

FOR MILITARY VEHICLES

K-S all-electric instruments
K-S Speedometers
Handy Vari-Speed Governors

FOR AIRCRAFT

Especially-designed equipment

FOR ARMY AND NAVY

Handy Servo Mechanical Governors

FOR THE GUNS

A variety of ammunition components

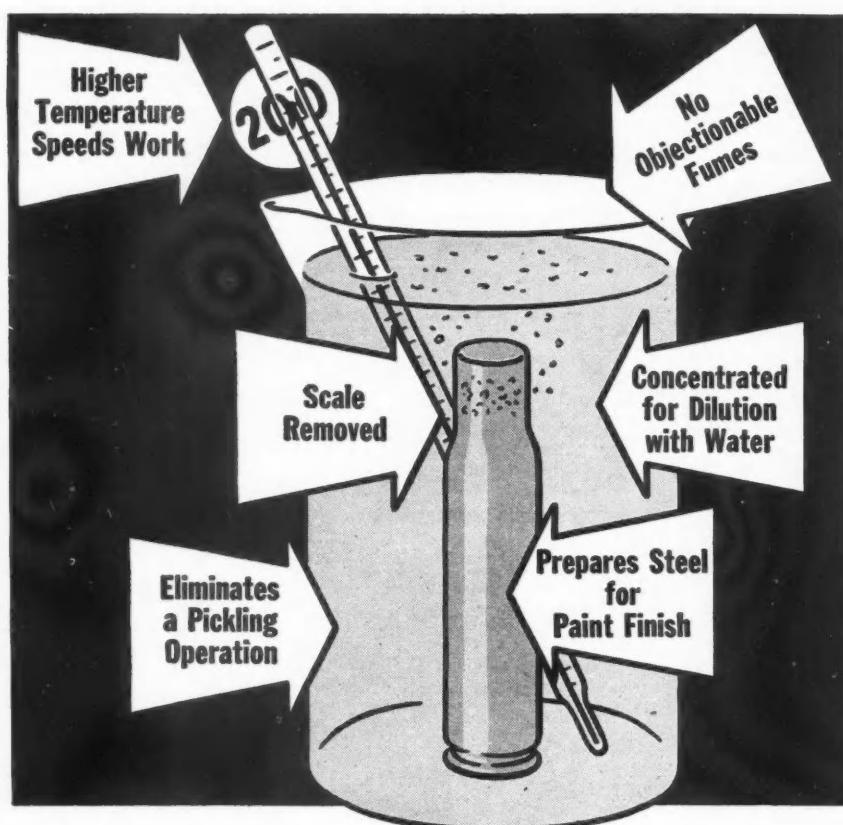


★ ★ ★ KING-SEELEY CORPORATION ★ ★ ★
ANN ARBOR MICHIGAN

Harry A. Miller

Harry A. Miller, 68, widely known designer of racing automobiles and speedboat engines, died May 3 at Detroit after a short illness. Miller Specials designed by him won 11 Indianapolis 500-mile races. He designed his first racing car for the Vanderbilt Cup race in 1906. Later he designed the egg-shaped "Golden Submarine" for Barney Oldfield in 1916. His first Miller Special won at Indianapolis in 1922 with Jimmy Murphy at the wheel. He is credited with introducing to automobile racing the aluminum body, front-wheel drive and four-wheel drive

car, aluminum alloy pistons, the supercharger, downdraft carburetor, four-wheel hydraulic disc brakes and mounting the radiator on the side rather than the front of the car. There were 17 Miller-designed cars in the 1925 Indianapolis race. He also built some marine engines for speedboats that set international records, and once was a partner with Gar Wood in a marine engine company. He sold his racing automobile engine company at Los Angeles to Fred Offenhauser and at the time of his death was building special aircraft hydraulic test equipment and experimenting with a 3,000-hp aircraft engine at his Detroit shop.



"DEOXIDIZE" for varnish finish with the New "170" type ACP DEOXIDINE

Whether you are preparing steel artillery shell cases, or any other metal product (except zinc) for varnish or paint finish you should investigate the new "170" type DEOXIDINE. For use in a dip operation, at either high or low temperature, to remove light annealing scale—thus eliminating an extra pickling bath—and also to perfectly prepare the surface for the paint finish, all in one simple operation.

Samples and directions for use sent upon request.

Manufacturers of Inhibitors and Metal Working Chemicals

AMERICAN CHEMICAL PAINT CO.
MAIN OFFICE AND WORKS
AMBLER - PENNA.
ACP CHEMICALS
ACP PROCESSES

DETROIT, MICH., 6335 Palmer Ave., E.
CANADIAN BRANCH
WALKERVILLE, ONT.

Business in Brief

Written by the Guaranty Trust Co.,
New York, Exclusively for AUTO-
MOBILE AND AVIATION INDUSTRIES

Approximately stable levels of general business activity are maintained. The seasonally adjusted index of *The New York Times* for the week ended April 24 was unchanged at 138.0 per cent of the estimated normal, as compared with 139.1 a fortnight earlier and 132.9 a year ago.

Department store sales during the week ended April 24, as reported by the Federal Reserve Board, were 29 per cent above the corresponding level in 1942. For the period of four weeks then ended, the total was 15 per cent greater than a year ago; and for 1943 to date sales have registered a comparable increase of 12 per cent.

Railway freight loadings during the week ended April 24 totaled 794,194 cars, 1.7 per cent more than in the preceding week but 7.8 per cent below the number a year earlier.

Electric power output during the same period rose contrary to the usual seasonal trend and was 19.9 per cent greater than a year ago, as against a similar excess of 18.4 per cent in the week before.

Crude oil production in the week ended April 24 averaged 3,912,600 barrels daily, negligibly above the figure for the preceding week but approximately 6 per cent less than the average output recommended by the Petroleum Administration for War.

Average daily production of bituminous coal in the same period was 1,967,000 tons, as compared with 2,075,000 tons for the week before and 1,916,000 tons a year ago.

Engineering construction contracts awarded during the week ended April 29, amounting to \$47,100,000, dropped 74 per cent below the corresponding total in 1942, according to *Engineering News-Record*. For the current year to date a similar decline of 55 per cent is shown.

Professor Fisher's index of wholesale commodity prices for the final week of April declined one fractional point to 111.8 per cent of the 1926 average, as against 106.5 a year ago.

Member bank reserves decreased \$169,000,000 during the week ended April 28, and estimated excess reserves declined \$60,000,000 to a total of \$2,280,000,000. Business loans of reporting members increased \$47,000,000 in the same period but stood \$1,081,000,000 below the total a year earlier.



Awards

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the May 1 issue of *Automotive and Aviation Industries* went to press.

AMERICAN LOCOMOTIVE COMPANY, Latrobe, Pa.

THE AVIATION CORPORATION, Republic Aircraft-Products Division, (two plants).

CHICAGO SCREW COMPANY, Chicago, Ill.

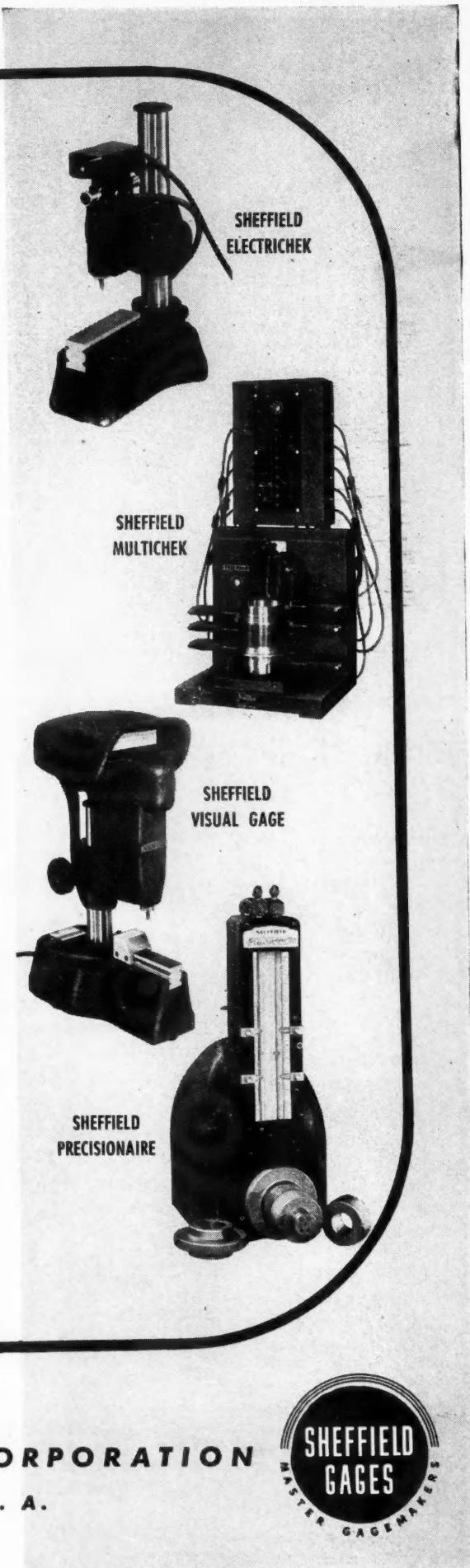
MICHIGAN PRODUCTS CORPORATION, Michigan City, Ind.

A lack of experience need not reduce inspection precision

It does require both skill and experience to handle close tolerance work on the time-honored fixed size gages—and skilled inspectors are scarce. But that need not interfere with precision in your plant.

Substitute for the gages that require skill, the gaging instruments which give you greater precision and at the same time eliminate the human factor. Sheffield precision gaging instruments in the hands of inexperienced inspectors are guarding product quality in hundreds of plants today.

Write for descriptive folder No. 43-1.



THE **SHEFFIELD**
CORPORATION
DAYTON, OHIO, U. S. A.



PUBLICATIONS

Turco Products, Inc. has issued a 14-page technical report on bright zinc plating as a substitute for cadmium plating. It gives complete descriptions of still and barrel plating, using a choice of three pre-cleaners, Turco, Penetrol, Turco Supertrol or Turco Composition L-570, and, as a final cleaner, Turco Porokleen.*

A revised edition of the engineering specification bulletin on the No. 2-24 Cincinnati automatic rise-and-fall milling machine has been issued by The Cincinnati Milling Machine Co. It features, in particular, the details of standard automatic feed cycles as well as a generalized special cycle,

typical of requirements for feeding to the right and left.*

Steel Tubing for Aircraft Use is the title of a new booklet compiled by the Ohio Seamless Tube Co. It offers up-to-date purchasing data, specifications, information and definitions. Material is presented in handy outline for easy reference.*

Bulletin 140, published by the Lindberg Engineering Co., is illustrated with photographs and sketches showing the many applications of **Lindberg furnaces** for the accurate heat treatment of aluminum, magnesium and their alloys.*

Summerill Tubing Co. has just issued a new 12-page booklet, Bulletin 443, covering useful information on the many specialties Summerill is producing, including tapered and formed tubes and a wide variety of special shapes. It includes a chart giving detailed information on the chemical com-

position of 25 different metals in regular production, size range available for each and mechanical properties and physical properties.*

Aluminum Industries, Inc., has published a new manual entitled **The Automotive Engine Piston**. It is designed primarily to give an elementary but fundamental understanding of the functions of the internal combustion engine piston and the principles of its operation and performance.*

The Engineering and Service Depts. of Oakite Products, Inc., have issued the third edition of a 12-page digest, presenting concise information in data sheet form on **cleaning, descaling, derusting, paint stripping** and other related techniques and procedures now being used to expedite 54 different factory and mill maintenance jobs. Formulas and methods are given for simplifying and speeding-up a wide range of work common to practically all plants engaged in war work or essential civilian industries.*

Hansen Manufacturing Co. has issued two new folders, one covering its **automotive air-line equipment**, which describes and illustrates its various types of cleaners, parts and appliances. The second folder covers **industrial airline equipment**, engine cleaners, air hose couplings, etc.*

Tool Steel Simplified, a new book published by The Carpenter Steel Co., Reading, Pa., is designed to meet the requirements for an easy to understand text for use in training schools, or in shops for upgrading or trouble shooting. It is priced at \$1.00 per copy.

Cone Automatic Machine Co., Inc., has issued a **Handbook for Operators of Six Spindle Conomatics**. It is well illustrated with photographs and drawings and contains tables of specifications, speeds and feeds, machine time charts, etc.*

* Obtainable through editorial department, AUTOMOTIVE and AVIATION INDUSTRIES. Address: Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

Obituary

W. Arnold Houser, 52, general parts and service manager of the Cadillac Motor Car Division of General Motors, died May 4 at Detroit after a short illness. He had been with Cadillac since 1915. He directed the Cadillac tank training school program. He was a member of the SAE.

Colonel Morrow Krum, who formerly handled public relations for Studebaker Corporation as a representative of Roche Williams & Cunningham, Chicago advertising agency, died in the crash of the Army bomber in Iceland which took Lieutenant General Frank M. Andrews, commander of U. S. troops in the European war theater, and 12 others, to their death May 4. Colonel Krum was Chief of Public Relations for the U. S. Army in the European war theater. He was formerly a vice-president of Leonard Macomber, Inc., Chicago advertising Agency, and prior to that Aviation Editor of *The Chicago Tribune*. He lived in Lake Forest, Illinois.

Albert L. Loveley, 63, a purchasing executive for the Packard Motor Car Co. and the E. R. Thomas Motor Car Co., Buffalo, from 1905 to 1913, died April 17 in Detroit. In recent years he had been a manufacturer's agent in Detroit.



ANOTHER NEW ENGINEERING DEVELOPMENT by WHEEL TRUEING TOOL COMPANY...

New Type Thread Grinding Diamond Tools

Equally effective in forming the wheel that grinds Whitworth, Buttress, Acme, or any other Special or Standard Thread.



Here's the pay-off: Gets the form quicker, holds it longer (*much longer*), does it faster, can be delivered sooner, serviced faster. Why? Because we have found out how to take advantage of diamond characteristics *never before utilized*. In one plant, production was increased 500% and the cost of each piece reduced 75%. In another plant, original production of 8 units per machine per day was increased to 80 units with no change except the use of these new type tools. But, the best proof is to *try them yourself*.

Tell us exactly what you want to do—We will furnish the TOOL TO DO IT BETTER . . . FASTER . . . at LOWER COST

Available
ONLY
from

**WHEEL TRUEING
TOOL COMPANY**

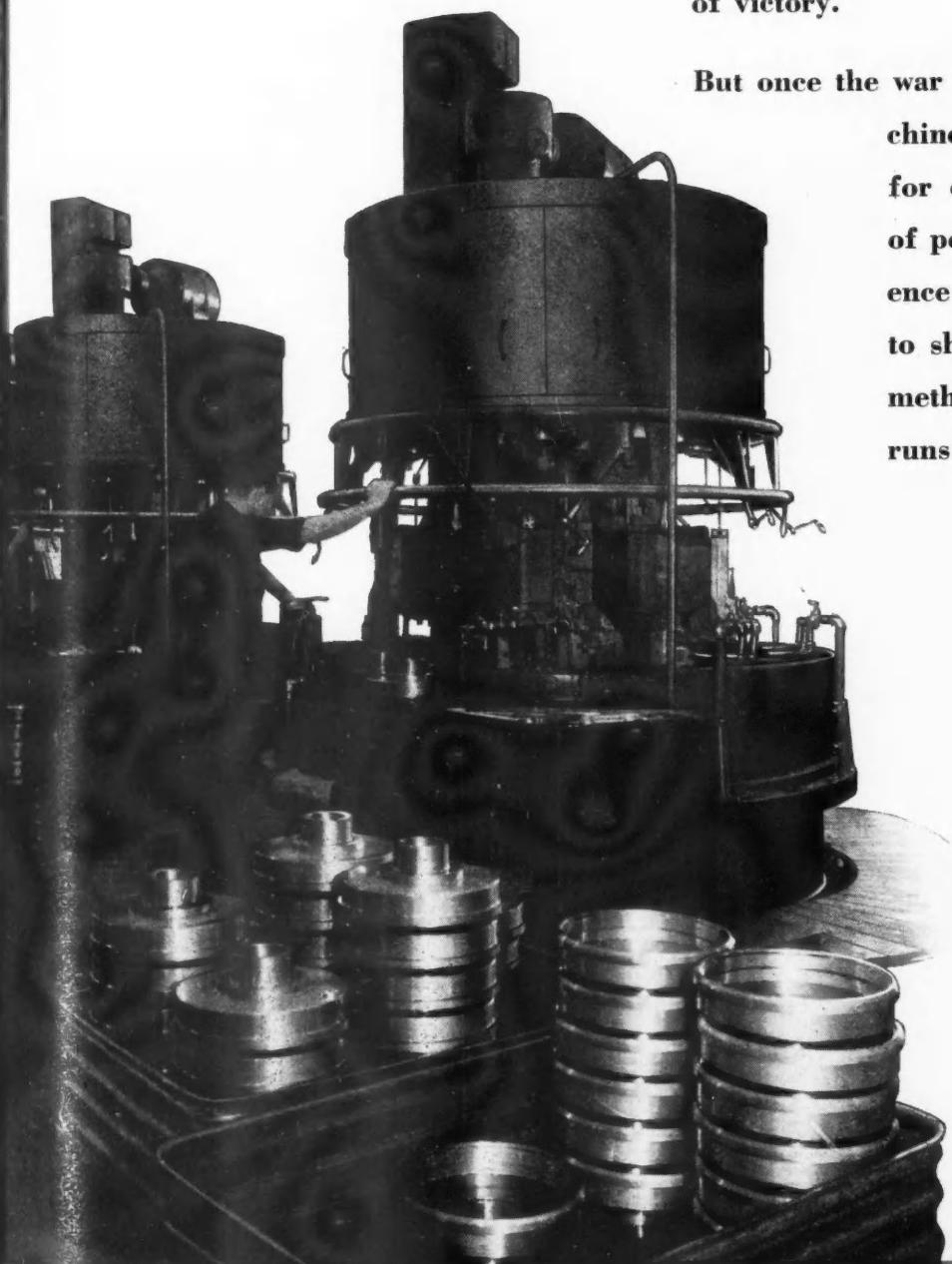
3200 W. DAVISON

DETROIT, MICH.

When the WAR is FINISHED BUSINESS...

As long as we need fighting planes, these Mult-Au-Matics will work hard at their present job. Their swift work is speeding the day of victory.

But once the war is won, these versatile machines can be quickly retooled for one or more of thousands of peacetime tasks. The experience of many plants is on record to show that the Mult-Au-Matic method effects economies on runs of even as few as 200 parts.



Rough and finish machining of reduction gears which are Nitralloy Steel forgings on a battery of Bullard Type "D" Mult-Au-Matics in an aeronautical plant. The 7 working stations, with independent speeds and feeds make possible all the work on these gears with but two chuckings.

THE BULLARD COMPANY
BRIDGEPORT, CONNECTICUT

Machine Tool Forum Draws Record Crowd

Three hundred representatives of machine tool builders and users attended the eighth annual Machine Tool Electrification Forum held at Pittsburgh, Pennsylvania, under the sponsorship of the Westinghouse Electric and Manufacturing Company. Delegates present represented 127 machine tool producers, having over 90 per cent of the producing capacity of this country, according to Tell Berna, general manager of the National Tool Builders Association.

While completely aware of today's

problem, namely winning the war, the engineers present were eager to learn of developments which will influence the design of post-war machines. Papers presented dealt with the training of unskilled help, selection of electrical equipment to save critical materials, and electronic devices applied to machine tools. A round table discussion on hydraulic versus electrical drives featured one of the two-day sessions.

Raymond M. Owen

Raymond M. Owen, 70, a pioneer automobile manufacturer and distributor, died April 29 at his home in Westport, Conn., after a long illness. At the

turn of the century he established agencies in Cleveland and New York for the Orient Buckboard Co. and the Oldsmobile Co. Later he operated agencies in New York for Mitchell, Premier, Franklin, Hudson and Essex. Mr. Owen built the Owen-Magnetic, a gasoline engine powered car which employed an electrical transmission system; he also built the Dyneto starting and lighting equipment used by Packard.

In 1941 he received a citation for distinguished service from the Automobile Old Timers, Inc. The citation noted "his confidence and grasp of automobile wholesaling, which developed the unparalleled performance of selling the entire output of the Reo Company from its inception in 1904 through 1914."

Ramco Package Wins Award

In the annual folding paper box competition devoted to conversion packages which save critical materials for the war effort, first award in Group 6 was given to the "Ramco 10-Up" Piston Rings Box manufactured for Ramsey Accessories Manufacturing Corporation, St. Louis, Mo. This competition is sponsored by the Folding Paper Box Association of America.

The prize-winning Ramco package, in company with winners in other groups, is now on display at the office of the War Labor Board in Washington.

"Bomber Nose" Test Chamber



This test chamber for aircraft radio and electronic equipment was developed by the RCA Victor Division of the Radio Corporation of America. It is built of transparent Plexiglas, a plastic made by the Rohm & Haas Company, and is actually the unfinished nose of a bombing plane. The transparent construction makes possible the complete testing and inspection of radio and electronic equipment under conditions duplicating the stratosphere at an altitude of seven and one-half miles.



IDEAL Live Centers not only permit deeper cuts at higher speed, but carry heavier loads, because the IDEAL Live Center rotates with the work. Radial load carried by high precision ball bearings, thrust load absorbed by high precision taper roller bearing. All parts hardened and ground.

2—IDEAL METAL ETCHER

Permanently Marks

Tools, Dies, Parts, Gages, etc.

New, all-purpose Etcher for permanently marking smooth-surfaced iron, steel and their alloys. 14 Heats. Etches legibly, easily, permanently, regardless of the hardness of the metal. Ground clamp for etching large, heavy parts and castings.

MOST COMPLETE LINE OF MARKING TOOLS

3—IDEAL DEMAGNETIZER

Keeps Tools Sharp Longer

Quickly demagnetizes work held in magnetic chucks, tools, drills, punches, dies, etc. Abrasive particles disappear after a single pass across the magnetic poles. For small or large work. Demagnetized tools cut faster because they do not bind, heat and dull quickly.

FREE—

Machine Tool Accessory Catalog gives information on these and many other time-saving tools.

IDEAL COMMUTATOR DRESSER CO.

3000 Park Avenue

Sycamore, Illinois

SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada, Irving Smith, Ltd., Montreal, Quebec

STOP LUBRICANT "ABSENTEEISM"



Lubricant, like manpower, is worthless unless it is at the right place at the right time. It must be kept in the bearing it is to lubricate.

"Perfect" oil seals stop lubricant "absenteeism" by keeping lubricant in the bearings. In addition, they keep mud, grit and other destructive foreign matter out of the bearings, thus keeping the bearing on the job.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1310 ELSTON AVENUE • CHICAGO, ILLINOIS

64 Years Manufacturing Quality Mechanical Leather Goods
Exclusively and now Sirvene Synthetic Products

PHILADELPHIA • CLEVELAND • NEW YORK • DETROIT • BOSTON • PITTSBURGH • CINCINNATI

MEN

The following were elected officers of the Perfect Circle Co. for the year 1943. **Lothair Teetor**, president and chairman of the board; **Ralph R. Teetor**, vice-president, and **Leslie B. Davis**, secretary and treasurer. Members of the Board of Directors are Lothair Teetor, Ralph C. Teetor, Macy O. Teetor, Don H. Teetor, Herman Teetor, Dan C. Teetor, W. B. Hartley and George H. Keagy.

Sherwin-Williams Co. has announced the following promotions in its sales personnel. **E. W. Windsor**, assistant to director of sales and distribution and manager of Kem-Tone sales, automotive sales and graphic arts sales. **C. F. Toll** has been ap-

pointed general manager of publicity and **L. W. Dasbach** is in charge of dealer and general advertising activities.

LaMotte T. Cohu, chairman of the board of Northrop Aircraft, Inc., has been named president of the National Aircraft War Production Council and president of the West Coast Aircraft War Production Council.

Hugh Willis has been appointed general sales manager of the Sperry Gyroscope Co., Inc. He was formerly chief research director.

Kellett Autogiro Corp. has announced the election of **Y. R. Yarnall**, formerly with Bellanca Aircraft Corp., as treasurer, and **H. H. Savage**, Philadelphia attorney, as secretary of the company.

W. B. Muse has been appointed sales manager of Industrial Abrasives, Inc. He was formerly associated with Sterling Tool Products Co. of Chicago.

S. Leroy Crawshaw has been appointed plant manager of the Lynwood Plant, Western Gear Works.

Osborn Mfg. Co., Cleveland, has announced the appointment of **Arthur B. Parnall** as treasurer.

Farrel-Birmingham Co., Inc., has announced the election of **John Wolcott Hadcock** as president of the company. He was formerly vice-president of the Sullivan Machinery Co., Claremont, N. H.

C. R. Dockstader, formerly staff assistant to the Vultee executive vice-president, has been appointed chief industrial engineer of the San Diego Division of Consolidated Vultee Aircraft Corp.

C. E. Powell has been appointed manager of the machinery department of R. D. Wood Company, Philadelphia.

W. O. Lippman has been made manager of the Westinghouse company's Canton Ordnance Division.

George A. Ball, Muncie, Ind., has been elected to fill the vacancy on the Board of Directors of Borg-Warner Corp., caused by the recent death of Frank C. Ball.

Burton F. Stauffer, assistant general manager of the Industrial Products Sales division of The B. F. Goodrich Co., has completed fifty years of service with the company.

William H. Harman has been elected president of William Sellers & Co., Inc. He was formerly with the Baldwin Locomotive Works.

Sav-Way Industries announces the appointment of **Otto W. Winter** as president. He was formerly with Republic Drill & Tool Co.

Elastic Stop-Nut Corp. has announced the appointment of **Walter J. Dreves** as vice-president and comptroller of the company.

Electro Metallurgical Sales Corp. has announced the appointment of **Herbert M. Rich, Jr.**, to the position of district manager in New York.

A. M. Wibel, vice-president and chief purchasing agent of the Ford Motor Co., has resigned. He had been with Ford since 1912 and had headed the purchasing department since 1927. He was elected a vice-president in July, 1941.

G. G. Sherwood, treasurer of the Henry J. Kaiser Co., has been elected a director of Brewster Aeronautical Corp., succeeding E. E. Trefethen, resigned.

L. T. Swallow has left the Chrysler Corp., where he headed the parts packaging engineering department, to form his own consulting firm of L. T. Swallow & Associates with offices in the Boulevard Bldg., Detroit.

Douglas B. Greig, treasurer, has been elected to the board of directors of the Ford Motor Co. of Canada, Ltd.

William L. Eaton, formerly secretary-treasurer, has been elected vice-president of Graham-Paige Corp. **Arthur L. Seiter**, formerly assistant secretary, has been advanced to secretary and **H. E. Sutcliffe**, controller, has been appointed treasurer.

William S. Newell, president of the Todd-Bath Iron Shipbuilding Corp. and the Bath Iron Works, has been elected a director of Mack Trucks, Inc.

H. Wallace Peters, a sales executive with Packard for 18 years and later assistant sales manager of Cadillac, has joined the Budd Mfg. Co., Philadelphia, in an executive capacity. He had been provost of Cornell University since 1938.

C. G. Trimbach, associated with Curtiss-Wright Corp. since 1929, has been appointed chief of the developments and armament department of the Curtiss Aeroplane Division research laboratory.

E. Robert Isbell has been appointed division manager of two subsidiaries of the Aviation Corp. at Toledo, the American Propeller Corp. and the Liquid Cooled Engine Division.

W. B. Fageol, Jr., formerly director of production and planning, has been elected a vice-president of Twin Coach Co.

T. M. Cummings, formerly vice-president, has been appointed executive vice-president of Progressive Welder Co., Detroit.

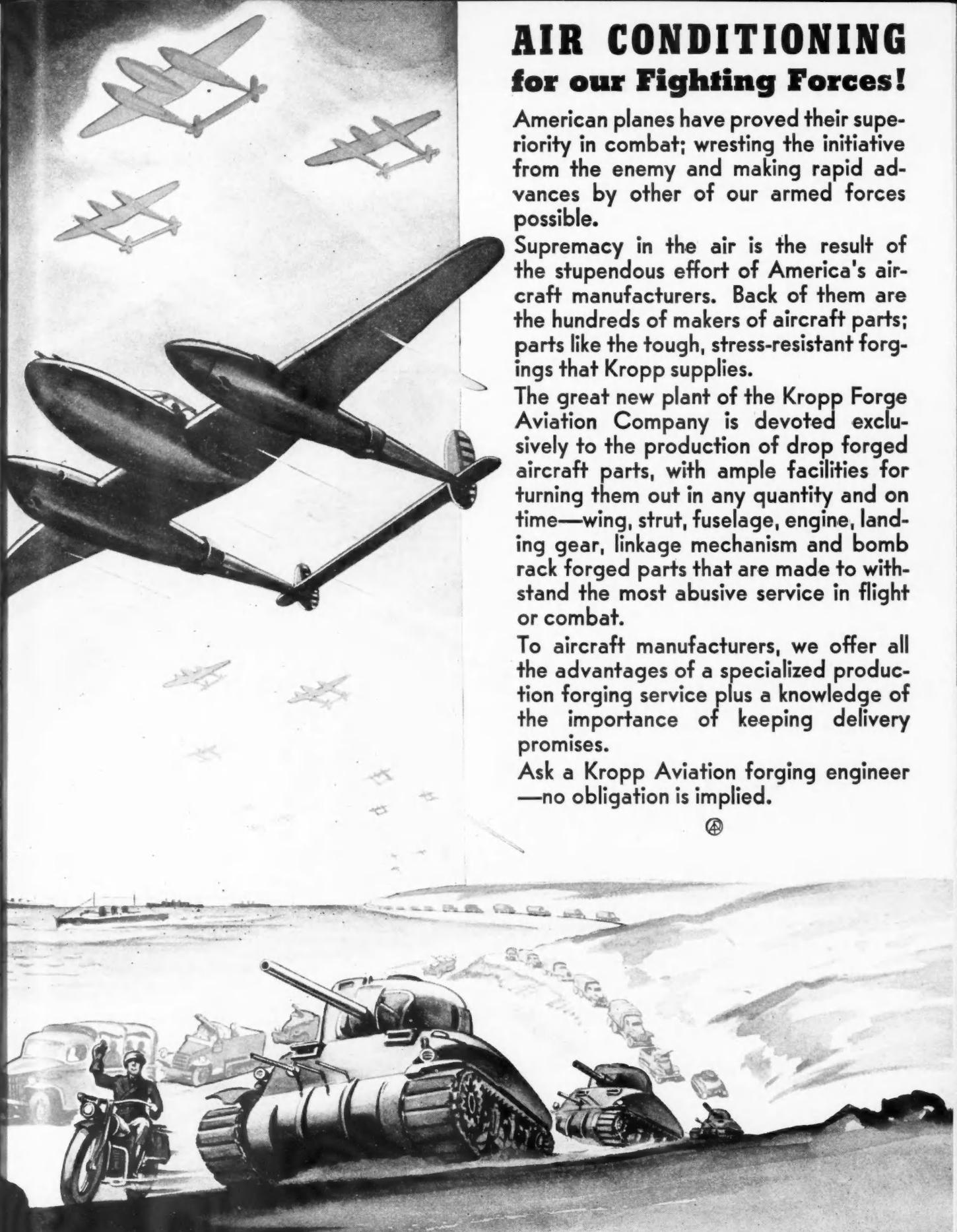
BORG & BECK

The Standard Clutch in Peace or War!

BORG & BECK DIVISION
BORG-WARNER CORPORATION

CHICAGO, ILLINOIS





AIR CONDITIONING for our Fighting Forces!

American planes have proved their superiority in combat; wresting the initiative from the enemy and making rapid advances by other of our armed forces possible.

Supremacy in the air is the result of the stupendous effort of America's aircraft manufacturers. Back of them are the hundreds of makers of aircraft parts; parts like the tough, stress-resistant forgings that Kropp supplies.

The great new plant of the Kropp Forge Aviation Company is devoted exclusively to the production of drop forged aircraft parts, with ample facilities for turning them out in any quantity and on time—wing, strut, fuselage, engine, landing gear, linkage mechanism and bomb rack forged parts that are made to withstand the most abusive service in flight or combat.

To aircraft manufacturers, we offer all the advantages of a specialized production forging service plus a knowledge of the importance of keeping delivery promises.

Ask a Kropp Aviation forging engineer —no obligation is implied.



Member of the A.C.C.A.



Kropp Forge Aviation Co.
CHICAGO
Engineering Representatives in Principal Cities

5301 W. ROOSEVELT ROAD

Production Speeded by Improved Methods and Simplified Designs

(Continued from page 46)

anti-aircraft cannon from \$1,280 to \$840 apiece, a saving of 34 per cent, according to OWI.

Many other automotive companies are helping build the "seven-ocean navy" which Secretary Frank Knox directs. Dodge Division of Chrysler Corp. is making intricate Sperry gyrocompasses for naval vessels. Production is in three figures despite the fact

that the 600-pound mechanisms contain more than 10,000 parts. Chrysler also is making Bofors 40-mm. guns, marine tractors and pontoons for the Navy. Hudson is manufacturing marine engines on 800 former automotive machine tools converted to war production. Hudson also is making mine anchors and fire control apparatus for naval guns, the latter at the naval

ordnance arsenal. Willys-Overland Motors, Inc., is turning out powder and projectile hoists for warships at a rate 33 per cent ahead of contract schedules. These hoists are 12 feet high, weigh three tons and contain 3000 parts, many of which are machined to fine tolerances out of bronze. They greatly increase the firepower of U. S. ships by rapidly passing the ammunition.

Many GM divisions besides Pontiac are producing naval ordnance and equipment. Fisher Body Division is making gun breech housing mechanisms for Navy 5-in. anti-aircraft guns. Cleveland and Detroit Diesel engine divisions and Electro-Motive Division are turning out propulsion equipment for submarines, mine layers, escort vessels and other naval ships. Harrison Radiator Division is making oil coolers and heat exchangers. Delco Radio Division is making radio equipment for naval ships and Delco-Remy Division is manufacturing batteries for naval use. Packard Motor Car Co. is an important factor in the naval program, producing the powerful marine engines that drive the PT boats.

Automotive plants also helped boost March military airplane production to 6200 planes, an 11 per cent advance over February, according to Donald M. Nelson's ninth monthly report on war production. Heavy bomber production for the first time passed the 500-a-month mark in March, while medium bomber output also increased and one-engine Army and Navy fighter plane manufacture showed especial progress.

Nelson was not too optimistic about March war production. He said that first quarter production was only 18 per cent of the 1943 schedule, which would make it necessary to average 27 per cent in the succeeding three quarters. The WPB munitions index rose from 482 in February to 533 in March. The latter contrasts with 201 in March, 1942.

Almost 3000 tanks were delivered in March as combat vehicle output advanced 13 per cent. A large number of self-propelled guns mounted on tank chassis (like the M-10) were turned out. Motor vehicle output increased 8 per cent. Overall gain in ground ordnance production was 7 per cent. During the first quarter of 1943 a marked gain was made in deliveries of important self-propelled artillery and anti-aircraft fire control equipment. First quarter production of nearly 18,000 artillery pieces included 7000 anti-aircraft guns and 8000 anti-tank guns as well as 235,000 machine guns and more than 1,000,000 rifles and sub-machine guns. A shift toward heavier types of equipment is evident throughout the range of ground ordnance, possibly an indication of the combat needs for a European invasion. Naval ship ordnance production, such as naval guns, ammunition, torpedoes, depth charges and mines, increased 13 per cent in March.

CONTINENTAL RUBBER WORKS

"THE HAND OF THE SPECIALIST"



The more the aircraft industry expands, the better it knows Continental. Forty years of industrial rubber experience, including thirty years of automotive engineering and ten years of pre-war synthetic development, have qualified Continental to give the aircraft industry the rubber assistance it needs at this time when it is most needed.

CONTINENTAL RUBBER WORKS
makers of the VITALIC



ERIE, PENNSYLVANIA • U.S.A.
line for forty years



**HYDRAULIC OILS by Houghton
PROVEN TO MEET TODAY'S MOST
DRASTIC SERVICE CONDITIONS...**

HYDRO-DRIVE MIH

In these days of 24-hour production, more and more men are examining with great care the types of oils which must be relied upon to give them longest trouble-free service.

If your hydraulic oils do not provide smooth operation, true indexing, with lack of jerkiness, you need a treated oil which has greater oxidation stability, greater strength, greater solvent ability.

Houghton's HYDRO-DRIVE Oils have these three outstanding properties, being specially fortified by modern scientific treatment of the best selected stocks.

HYDRO-DRIVE Hydraulic Oils provide a tough lubricating film three times stronger than possessed by the same oils untreated. Their stability means that they resist pressures, heat, moisture and agitation. Their solvent ability prevents deposition of gum and sludge for greatly extended periods.

Compare HYDRO-DRIVE MIH against other oils. Permit our technical men to take drainings at regular intervals, without interrupting production. The reports you will obtain will convince you of the advantages to be obtained from changing to Houghton's "fortified" hydraulic oils.

Write for the HYDRO-DRIVE Booklet, prices and service details

E. F. HOUGHTON & CO.
PHILADELPHIA • Chicago • Detroit • San Francisco

*Other Houghton Products: VIM Leather Packings • VIM Tred
Leather Belting • Lubricants • Cutting Oils • Quenching Oils
Heat Treating Compounds • Metal Cleaners • Rust Preventives*

Unauthorized Work Stoppages Continue in Many War Plants

(Continued from page 50)

ing Negroes. This recent racial trouble, which the union blames upon segregation of new Negro workers in certain departments, comes at a time when the government is trying to increase the employment of Negroes in war industry. The Detroit representative of the President's Committee on Fair Employment Practice telegraphed the Ford foundry strikers deplored

the recent stoppage as inimical to the war effort and "because many Negro workers are involved, the strike will do more harm than good in the public mind, as it strengthens the hand of illiberal persons who are against the minority group's full participation in war industry."

Employment of Negroes in Detroit's major war plants has more than dou-

bled in the last year, according to M. A. Clark, district director of the WMC. In March, 185 of the largest plants representing 75 per cent of Detroit factory employment had 47,400 Negroes on their payrolls out of a total of 566,600 workers. This was 8.4 per cent of the employment compared to 9.2 per cent of Detroit's population being Negro, according to the 1940 census. In May, 1942, these same plants had 22,200 Negro employees out of 394,400, or 5.6 per cent. Fifty-nine per cent of the Negroes employed in non-ferrous metal industries are in jobs above the unskilled level. Some are working as toolmakers, foremen, millwrights and machine repairmen. Negro workers constituted 24.6 per cent of the 22,248 placements made by the U. S. Employment Service in the Detroit area during March.

Negro employment in 901 large war plants in Ohio employing nearly 900,000 workers increased 46 per cent in the last six months of 1942 compared to a 67 per cent increase in women employees. However, Negroes comprised only 4.8 per cent of the total employment of these firms and WMC officials say this will have to be increased appreciably to meet manpower quotas.

Many employers have been willing to hire Negro workers but afraid of the reaction it would have on their white employees. There was a brief walkout at the Packard Motor Car Co. when four Negro women were hired in the machine shop. A two-day strike occurred at the Timken Roller Bearing Co., Canton, Ohio, in protest over equal treatment accorded 27 Negroes in matters of seniority and promotion. More than 50 plant guards at the Hudson Motor Car Co. staged a brief walkout over the hiring of three Negro guards. The WMC ordered the return to his job of a Negro welder's helper at the Duplex Printing Press Co., Battle Creek, after 125 welders walked out in protest over his employment. The Negro was hired through the USES after taking a welding course. The WMC also advised the International Association of Machinists (AFL) that the Negro should be utilized at his highest skill. Last fall there was a work stoppage at the Naval Ordnance Arsenal operated by Hudson over employment of Negroes and a similar stoppage at the Kelsey-Hayes Wheel Co.

In the first NLRB recommendation involving racial discrimination, a trial examiner recently upheld the Glamorgan Pipe and Foundry Co., of Lynchburg, Va., in the firing of two white employees who threatened to call a strike over the assigning of a Negro crane operator. The USW-CIO charged that the men were fired for union activity. One man was subsequently rehired.

Employment of Negro women workers has been retarded by the resentment of white women employees, especially over sharing lunchroom fa-

BUELL AIR COMPRESSOR

BUELL Air Compressors are used on bomber and fighter planes to operate brakes and machine guns. Here, where reliability is of first importance, their fine workmanship and precision manufacture pay real dividends in dependable operation. 12 years of operation on cars, trucks, buses, boats and railway trains was the proving ground for their adoption as an aviation accessory.

BUELL Air Compressors can be operated at speeds of 2000 to 3400 R.P.M. Pressures in excess of 225 pounds are built. Safety control of air pressure is automatically handled by Buell design and retention of air is assured thru precision valve construction. Self contained oiling, bronze connecting rod and bearings. Moving parts are held to a tolerance of .0002".

ACTUAL SIZE
WEIGHT 5 LBS.

DISPLACEMENT 1.2 CU. FT. AT 3500 R.P.M.

AVAILABLE ON PRIORITY

BUELL MANUFACTURING CO.
Dept. AA, 2975 COTTAGE GROVE AVE., CHICAGO, ILL.



We're not interested in ZOOT SUITS

but we are interested
in the phenomena
of change . . .

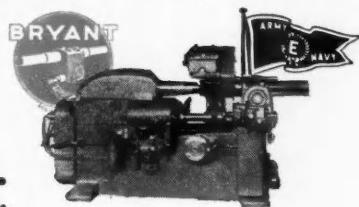
We're not rug cutters, and we're distinctly not "right with the rags." We don't wear a "solid suit of threads," padded at the shoulders like a lunatic's cell, with the "jut cuts" and the "reat pleats," the "cleave sleeves" and the "drape shape." That sartorial throw-back of a juvenile ego is definitely not down our alley.

We're specialists in internal grinding problems, and Zoot suits (we fervently pray) won't wield their foolish influence upon the wheels of industry . . . but many a simple fad has!

When a boy and a girl once sat in a hammock, and he thrummed a mandolin and she softly sighed, "I just love your new soft collar"—the celluloid collar market quietly vanished from this earth . . . And the horse-and-buggy business employed a million men—until an explosive contraption, deplored as a dangerous fad, noisily disemployed them and put ten times their number to work.

No, we're not interested in Zoot suits, but we are interested in the phenomena of change. And this is the fastest-changing period in all of industrial history. As a result, many businesses, seemingly on the rise, are actually on the brink of failure in the post-war world of better and cheaper materials.

We've developed many new techniques in grinding these materials, and we believe that this knowledge can be of greater value to manufacturers today than ever before. Bryant's Consulting Service is available to you at all times, and we urge you to call upon us now!



GYANT CHUCKING GRINDER CO.
SPRINGFIELD, VERMONT, U. S. A.

SEND FOR THE MAN FROM BRYANT

cilities and rest rooms. It is estimated that 9000 Negro women are available for employment in Detroit war plants although it was recently charged that only 200 out of 4000 Negro women trained for war jobs in the Detroit area had been hired. Briggs Mfg. Co. has had conspicuous success in employing both white and Negro women in harmony. Every new worker is given a complete physical examination to guard against communicable disease. Then a company woman counsellor talks to each new employee and sees that she is properly settled in her new job. The union and the company co-operate in making the new women feel

their job responsibility. Women of all races are trained together in the Briggs training school and an effort is made to alleviate any sources of friction that may develop.

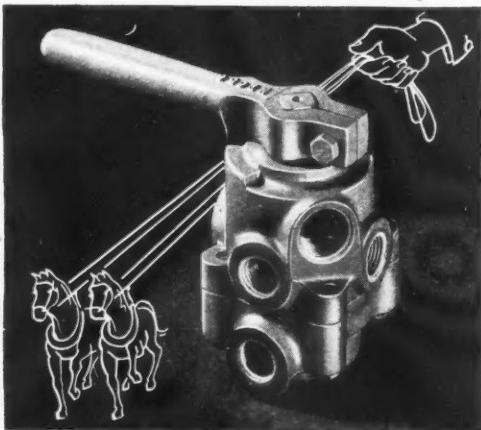
A three-day strike that made 17,500 employees at the Ford Motor Co. of Canada, Ltd., Windsor, Ont., idle finally was ended when the company and the UAW-CIO agreed to the appointment of Louis A. Fine, chief government conciliator for Ontario, as arbitrator. Fine brought about a settlement through an agreement to install a hoist to handle 200-pound castings and to deprive a foreman, who was continually booted by employees, of

handling union grievances. The company is the largest maker of mobile military equipment in the British empire.

Increased Vauxhall Profit for 1942

The annual report for 1942 of Vauxhall Motors shows that this General Motors British subsidiary became liable last year for Excess Profits Duty for the first time. Trading profit, after providing for all taxation, rose from £985,545 to £971,201 and net earnings after depreciation and debenture service from £399,285 to £460,184.

*Control
Simplified!*



* NOPAK Dual 4-Way Valve Controls Two Cylinders with One Lever

* Embodies NOPAK Patented Cored-Disc Principle and other famous NOPAK features.



NOPAK CYLINDERS — for Air or Low Pressure Hydraulic Power, available in Standard and Heavy Duty Types, with Adjustable or Self-Regulating Cushions. 6 Standard Mountings.

This sturdy, compact, NOPAK Valve can take the place of two four-way valves in applications where two double-acting cylinders are used in close relationship to one another. The four independent outlet ports are arranged so that two cylinders may be operated in either direction in any sequence required.

With this valve a variety of operating cycles may be set up, and controlled with a single lever. This is an advantage where inter-dependent machine movements must be accurately governed.

The Dual 4-Way gives you the operating advantages you have learned to expect of all NOPAK Valves . . . long-lived, maintenance-free service, precision control, easy finger-touch operation.

If "one lever control" of two cylinder movements would result in simplified operation, write for further information.

GALLAND - HENNING MFG. CO.
2774 S. 31st Street
Milwaukee, Wis.

Representatives in Principal Cities

NOPAK VALVES and CYLINDERS
DESIGNED for AIR or HYDRAULIC SERVICE

A 3936-1/2 I-A

Droppable Fuel Tanks

(Continued from page 29)

it rises high over the railroad tracks, over a platform where a girl installs decals showing the manufacturer's name, the tank capacity, etc., and where anti-sabotage seals are placed over all openings. The line moves outdoors, where a protective coating of Paralketone is applied by a spray gun, and then returns to the shipping building for crating. The crated tank is then placed aboard a freight car and is ready for shipping to a seaport, where it will be placed aboard a ship bound for one of the fighting fronts. With the aid of droppable tanks, hundreds of P-38s are being ferried across the Atlantic to England and North Africa. On these transoceanic hops the fighters are convoyed by Flying Fortress bombers, which handle the navigation problems.

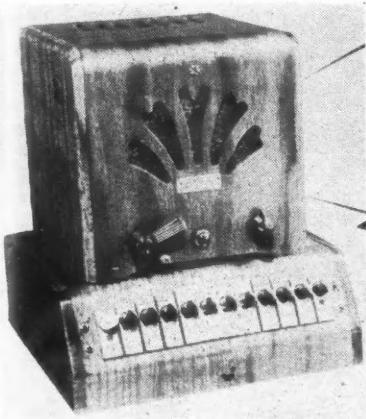
Focke Wulf FW 190-A-3

(Continued from page 38)

ata), the tail wheel is mounted in a fork attached to the lower end of the shock absorbing cylinder and connected to a link to a point farther forward in the fuselage. The fork is rotatable through 360 deg, but is centered by a hairpin type of spring. It can be centrally locked by a gear, which is operated by the elevator control rods when the control column is pulled right back. The upper end of the oleo piston carries a toggle with two rollers placed inside a pair of channels mounted inside the fin (see page 37) and so shaped that in its lowest position the two rollers lock the unit. A cable passing over a series of pulleys connects the toggle to one of the links in the starboard main undercarriage. When this cable is pulled the toggle is rolled over and the rollers can then be drawn up the channel, so that the tail-wheel is partly retracted into the fuselage. When the cable tension is relaxed a spring pulls the rollers down and locks them in their lowest position.

Part Two will appear
in an early issue.

New Products



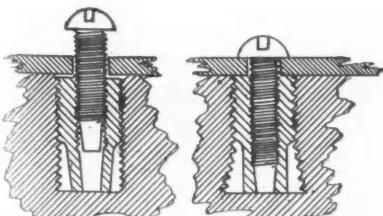
Executone Central Control Master Station

Communication System Has New Selector

A central control master station equipped with an annunciator selector having a buzzer, and name tabs which illuminate to identify incoming calls, is the latest addition to the line of communicating units made by Executone, Inc., New York, N. Y. Built into a detachable base which can be replaced with larger capacity selectors for future expansion, this unit enables the user to talk individually to up to eleven other remote stations in the system, or page them all simultaneously. Any other station in the system can signal and register its call on the master station's annunciator selector.

Each of the name tabs lights up to identify the incoming calls, and remains illuminated until each call has been received. A manual buzzer, which sounds to signal that another station is calling, can be cut off by means of a toggle switch.

A lever at the side of the cabinet controls a tone signal which can be transmitted selectively or simultaneously to all other stations in the system. The top portion of the master station is an Executone Model KC amplifier with an output of four watts, and a microphone speaker.



Marco Mushroom Insert

Permanent Holding Mushroom Insert

The Marco Permanent Holding Mushroom Insert is a new type of threaded insert being made by the Marco Company, Inc., Wilmington,

Del. Expansion of the insert accomplished by inserting a hand tool shaped to conform to the taper at the bottom, or a tool of similar shape can be applied in either a trip or air gun. Insertion of the tool causes the insert to mushroom out at the bottom, forming



A 12 ounce Sentry

It's the VISCO-METER* we're talking about... 12 ounces of mechanical precision doing wide-awake sentry duty on gasoline and Diesel engines in the services and on the home front.

In an engine—be it marine, motor transport or supplying power for landing field lights—efficiency and service life are measured in terms of constant, correct lubrication. Anything less than making sure is an invitation to trouble.

And VISCO-METER* is the one dependable means of *making sure*. Via its gauge, the VISCO-METER* is visual entry to the crankcase, continuously telling the operator the lubricating value (viscosity) of the oil while the engine is in operation.

Uncle Sam is thorough. Long before the war, VISCO-METER* was in service on government truck engines... and proving its worth by warning of impending lubrication failure as well as effecting economies in oil consumption. That's why VISCO-METER* production has been "upped" to a new high and every unit enlisted for sentry duty.

It won't be long before VISCO-METER* production will be available for peacetime use on all types of internal combustion engines... inexpensive and necessary to make an engine complete. Service records are more convincing than words. A VISCO-METER* engineer will help you get ready for tomorrow.

VISCO-METER
CORPORATION GROTE ST., BUFFALO, N. Y.

*Fully covered by U. S. and Foreign Patents



We're in the Army, Now

...In the Navy and in the Air Corps too!

In Iceland and Ireland, . . . from Africa to Australia, Clayton Kerrick Kleaners are helping our mechanized units keep on the move . . . by keeping them clean, so they can be quickly inspected, serviced or overhauled. That's an important assignment which Kerrick Kleaners do better than any other type of degreasing equipment . . . and is the reason Kerrick Kleaners are in the Army Now!

Another Task Force of Kerrick Kleaners is serving on the home front, performing hundreds of difficult cleaning jobs for essential war industries . . . speeding production and contributing substantially to the war effort.

Whether it's cleaning a tank, truck, airplane, battleship, factory floor or a small repair part, Kerrick Kleaners do it faster, better and cheaper.

The Kerrick Kleaner is but one of several Clayton specialized products which are being produced in unprecedented quantities for the armed forces. The others include: Clayton Flash type Steam Generators . . . Hydraulic Dynamometers . . . Hydraulic Liquid Control Valves . . . Boring Bar Holders and Boring Bars . . . and Kerrick Cleaning Compounds.

The Kerrick Kleaner scientifically combines heat, water, a detergent and pressure to dissolve and remove the most stubborn grease and dirt from all types of surfaces. Illustrated is portable trailer Model L-OET.



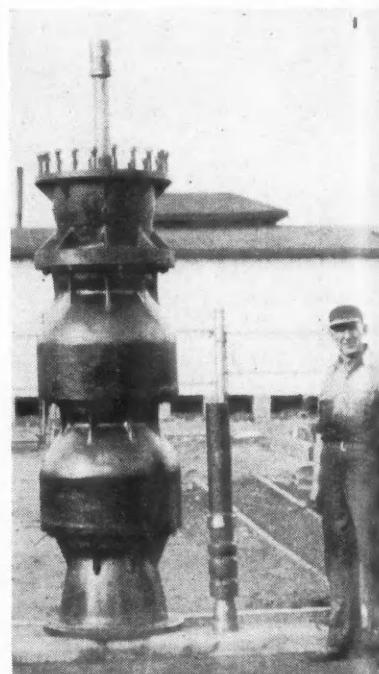
CLAYTON
Manufacturing Company
ALHAMBRA, CALIFORNIA

a star-like projection, and as the metal is not cut through either before or after the operation, there is no possibility of its springing back to the original shape.

The type of thread or screw is optional. Blank inserts are available for drilling to template after insertion.

**High Capacity
Turbine Pumps**

A line of vertical turbine pump bowls is being offered by Layne & Bowler, Inc., Memphis, Tenn. They are intended primarily for pumping water from streams or lakes for war plants, but may be used in large diameter wells.



**High capacity vertical pump bowls
made by Layne & Bowler, Inc.**

for industrial or municipal water supplies.

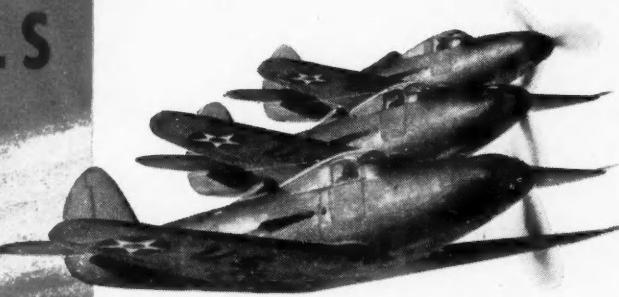
The new line of high-capacity, large diameter bowls includes designs for capacities up to 16,000 gallons per minute, and all bowls are true turbine type. High efficiencies throughout a wide capacity range, and non-overloading impellers are said to make these units especially desirable for pumping from rivers or streams where fluctuating water levels are encountered.

Alternates for Rubber

Felt Products Mfg. Co., Chicago, Ill., is introducing three new products; R-196, Syntoflex and a synthetic rubberized strip material. R-196 is a reclaimed rubber material in plain gasket form, and is suitable for applications where high tensile strength and tear resistance are not essential. Syntoflex is a new synthetic material which is said to be satisfactory under severe

SNAP-ON TOOLS

THE CHOICE



OF AVIATION

"Because They Best Fill The Bill"

In every branch of aviation . . . in airline maintenance and overhaul . . . in engine and parts manufacture . . . and along the industry's great assembly lines . . . Snap-on tools are used, preferred, endorsed. Because they are designed and built to meet aviation's need for speed, accuracy, extreme flexibility. Because, in the words of Bell Aircraft Corporation:

"The compactness of advanced aircraft design such as Airacobra requires flexible tools that are strong and reliable. We use Snap-on tools because *they fill this bill best* for Bell Aircraft Corporation."

"Filling the bill best" for aviation . . . meeting the urgent needs of factory, assembly line and of America's Flying Forces . . . is today a prime responsibility of Snap-on. Write for catalog of 3,000 Snap-on tools, and address of a nearby Snap-on factory branch.

SNAP-ON TOOLS CORPORATION
8054-E 28th Avenue KENOSHA, WIS.



conditions, such as contact with oil or grease. The synthetic rubber strip material consists of a felt base impregnated with synthetic rubber. It simulates the spongy characteristics of sponge rubber stripping, and is obtainable in various shapes in lengths up to six feet.

Protective Coating for Steel or Iron

A new coating for metal products has recently been developed by the Chicago Vitreous Enamel Product Co., Cicero, Ill. It is called Armor-Vit, and is essentially an alkali alumina silicate hav-



Section of steel pipe, right half coated with Armor-Vit, left half uncoated, after exposure to weather for five months



★ In your finishing operations, be they metal, wood, plastic or what-have-you, you can erect tiny monuments to wasted man hours and lost material because of rejects. Or you can maintain a finishing schedule with a plus of increased production, better finish and lower operating costs.

It's up to you.

More and more prime and sub-contracting manufacturers are finding the answers to their finishing problems in McAleer *Quality-Controlled Materials and Methods*. You would be wise to put your toughest finishing problem up to McAleer where 18 years of successful industry-wide experience would be concentrated in answering your specific finishing problem . . . whether that problem meant minimizing rejects for increased production and better finish or lowering operating costs, or both. Whatever it is, let us demonstrate McAleer service on your toughest finishing problem. That's all we ask. As to results, you be the sole judge.

McAleer MANUFACTURING CO.
Quality-Controlled Finishing Materials
ROCHESTER, MICHIGAN

ing high thixotropic properties, and containing silica, alumina and silicates as important ingredients. It may be applied by spraying or dipping after the metal has been cleaned by ordinary cleaning methods. After application, Armor-Vit is cured by heating to 750-800 deg. F., which combines the ingredients of the coating into a hard, heat-resistant finish, insoluble in boiling water and resistant to most acids and alkalis.

Plastic from Redwoods

A new non-critical type thermoplastic is available for both war and civilian production of many items formerly manufactured from other thermo setting plastic compounds or hard rubber. It is called Shellerite, and credit for its discovery is shared by The Pacific Lumber Company, San Francisco, Cal. The Institute of Paper Chemistry, Appleton, Wis. and the Sheller Manufacturing Corporation, Portland, Ind. Shellerite is made from redwood chips which are subjected to a short cycle of high pressure steam until the phlobaphenes within the cell structure are reacted. After being defiberized, the resultant fibre or powder produced becomes the thermoplastic substance. The new thermoplastic is said to produce finished products of excellent tensile strength and attractive appearance. When special properties are desired, it can be mixed with other resins and other plasticizers.

Inspection Mirror Has Quick Locking Device

The Snap-On Tools Corporation, Kenosha, Wis., has designed an inspection mirror for use in assembly operations, machine shop work and service work where it is necessary to inspect work from behind, or where obstructions block the worker's view. It is called the Blue-Point "See-Eee-Zee" Mirrorview,



The Blue-Point "See-Eee-Zee" Mirrorview

and features a locking device, operated by one hand by means of which the mirror can be locked in any position within a 90 deg. arc after it has been inserted past obstructions. The mirror returns to a straight position automatically when the lock is released. Replacement mirrors are available, and are easily inserted into the holder.

Two New Doall Products

The Doall Company, Des Plaines, Ill., has recently put two new products, Doall Saw Eez and Doall Steel Ink, on the market. Doall Saw Eez is said



Will Peace Come In Our Time?

Most certainly it will—and sooner than you may expect. With it will come the crucial test of whether or not American industry can convert as efficiently to peace as it has to war. From our extensive relations with hundreds of varied manufacturers we know of scores of amazing new products that only await the message of peace to come into being. Everyone looking ahead to that great day can even now count on the assistance of the Weatherhead plants which are producing vital parts for planes, tanks, ships, cars and trucks at the rate of *millions every day!*

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

*Manufacturers of vital parts for the automotive, aviation,
refrigeration and other key industries.*

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

to withstand extreme pressures, and to minimize scoring and heating of saw blades. It may be used as a lubricant on lathe centers, circular saws and other surfaces which require intermittent applications of a tough film lubricant.

Doall Steel Ink is for use in precise layout work on dies, templates and machine parts, as well as to locate high spots on scraped machine ways, to check gear tooth contact, and to determine the relation of mating surfaces. The ink is not attacked by machine oil or the usual soluble or cutting oils, yet it can be removed

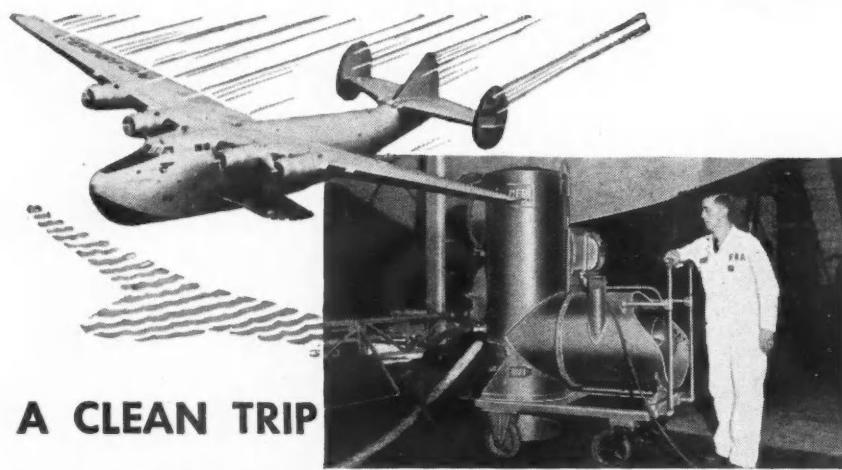


Hi Load Caster

readily when machining operations are completed, by means of an alcohol moistened cloth.

Heavy Duty Caster

Cutaway view of the "Hi Load" caster made by Divine Brothers Company, Utica, N. Y. It is designed for use where the imposed load per unit is too high for the ordinary type caster. The top plate is a forging with integral king bolt stud, and the legs are of heavy structural steel welded to the yoke. A Timken tapered roller bearing absorbs thrust action, while the load is carried on a ball type bearing.



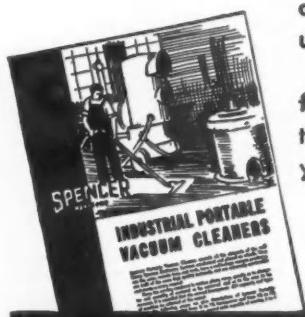
A CLEAN TRIP WITH PAN AMERICAN AIRWAYS • • •

Also used for

- CLEANING
- RECLAIMING
- MOVING
- MATERIALS

In the

- PRODUCTION
- OF ALL ESSENTIAL
- WAR MATERIALS



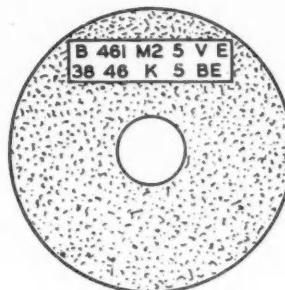
Few people realize the extent of reconditioning between trips of huge ocean clippers. Every Pan American clipper starts out spotlessly clean. Spencer 5 HP Portable Vacuum Cleaners with long hose lines reach every spot, not only the floors, rugs, and furniture, but all the machinery.

Most of the big airplane manufacturers also use Spencer Vacuum. Babbitt is picked out of engine heads, stray bolts, nuts, etc., removed from wings and fuselages, bench cleaning is speeded, and the finished job is cleaned before delivery. It is ideal also for the manufacture of the many instruments used in all forms of modern transportation.

Spencer Vacuum for industrial service ranges from $\frac{1}{4}$ to 100 horse power, portable and stationary. There's a Spencer representative near you. Ask for the Spencer Bulletins.

SPENCER VACUUM
CLEANING
THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

243 A



variations of structure (three of which are marked as preferred), and six different bonding processes.

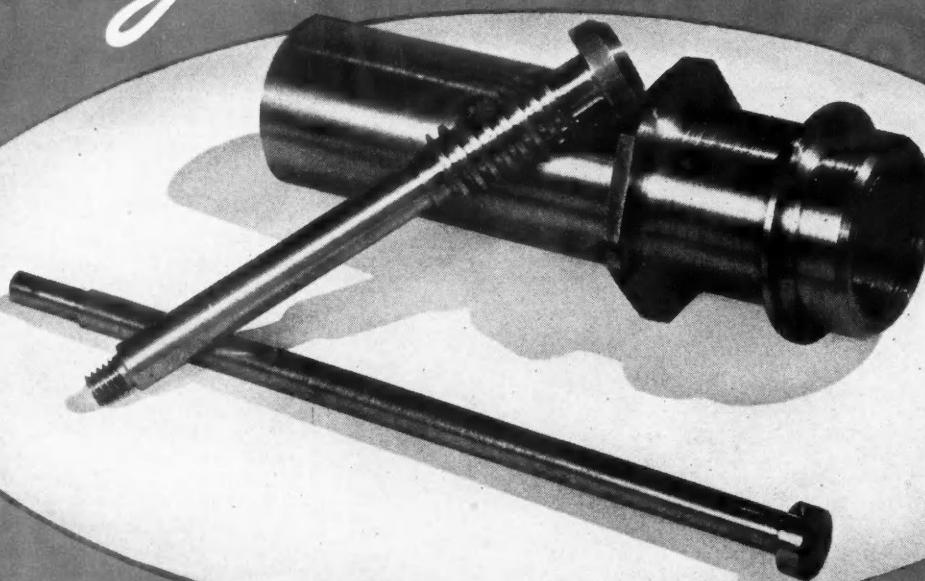
The accompanying diagram represents a grinding wheel with double markings. The top line corresponds to the new American Standard, while the bottom line represents the manufacturer's markings. The meanings of the different symbols are made clear by the following table:

G.M. Mfr.	Abrasive	Grain Size	Hardness or Grade	Structure	Bond or Process	Manufacturer's Records
38	B	461 46	M2 K	5 5	V BE	

Grinding wheel manufacturers have expressed the hope that the new standard will be of help in ordering new wheels and in the adaptation of those on hand to new operations.

WILL YOUR DIE HEADS

do jobs like these?



**1 5/8" Self-opening Head
with Circular Hollow Mills**

In the same rigid head, circular thread chasers are interchangeable with hollow milling cutters and blocks.

National Acme Engineers will gladly work with you on special or difficult hollow milling and threading operations.

NEW PRODUCTION RECORDS, for both precision and speed, are being made with Nameco Circular Cutter Hollow Mills.

On a wide variety of end forming and end turning operations, these tools bring to many production plants important new advantages over single point milling tools—

1. Same "double duty" head used for both threading and end forming cuts.
2. Circular type cutters have 270° of circumference available for regrinding.
3. Cutters removed for grinding without disturbing setup, and replaced without changing precision in work.

Catalog D-42—sent on request—will bring you valuable help in saving time, increasing production, and reducing costs.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

New Products for Aircraft

(Continued from page 40)

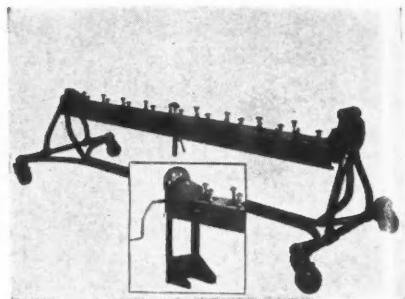
Stand for Aircraft Engine Cylinders

The Clayborne Cylinder Stand for assembly and overhaul of aircraft engine cylinders is the latest addition to the line of engine handling equipment offered by Motor Rebuilding Specialties, Chicago, Ill. In the standard model, the long cylinder box contains nine openings to receive cylinders, each with a pair of clamps to lock in the cylinder and hold it in rigid position.

The entire cylinder box may then be rotated to any desired position to secure complete access for valve assembly. The Cylinder Stand is available in both portable and stationary models as shown in the accompanying illustration.

Ammunition Rounds Counter

A recent development in aircraft accessories at National Machine Products, Los Angeles, Cal., is an Ammunition



The Clayborne Cylinder Stand for aircraft engine cylinders.

Rounds Counter, designed to tell the operator of an aircraft machine gun or cannon exactly how many rounds of ammunition he has remaining, and whether the weapon is functioning properly.

The Ammunition Rounds Counter is a small instrument, with a face no larger than an ordinary pocket watch, and weighing five ounces. It is designed to be mounted on any instrument panel and in any desired position.

A knob in the center of the dial is used to set the pointer for the exact number of rounds of ammunition with which the gun has been provided, and as the gun is fired, the pointer travels towards zero, showing empty only when the last round has been fired. Recessed in the center of the reset dial is a small pilot light, which is electrically connected so as to blink with each shot.



PHOTO BY U.S. ARMY SIGNAL CORPS.

For the Right Solution—

the First Time

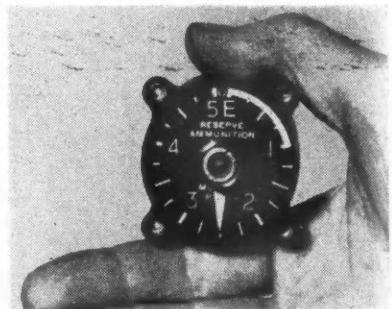
**CALL A STERLING
PISTON SPECIALIST**

For years Sterling Engineers have been leading the field in designing pistons that contribute to better motor performance. These exclusive designs produced under patented molding processes give better, more uniform pistons.

**STERLING ALUMINUM PRODUCTS
SAINT LOUIS**



STERLING
PISTONS



Ammunition Rounds Counter made by National Machine Products

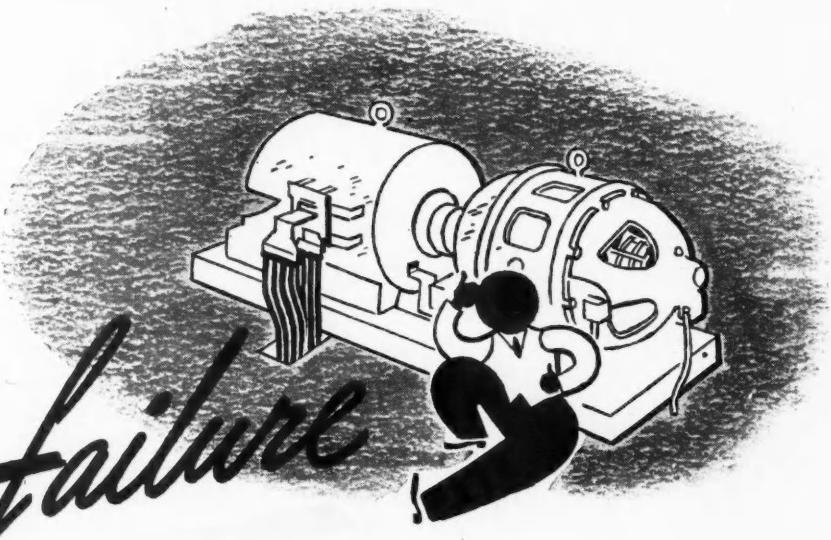
fired. If the gun jams, the light will not work, and if the rate of fire is reduced from over-heating or otherwise, the speed of the flickering light is reduced as a warning to the gunner.

A fluorescent red stripe around the last twenty per cent of the pointer's travel serves as a warning signal to the gunner that his ammunition is running low. The pointer's numerals and divisions are all a pale green fluorescent paint against a black background.

The operating unit is mounted on a gun or cannon, and actuated by the bolt stud with each round fired, and electrically connected to the gunner's panel.

The current consumption is .035 amp. for the light, and .06 amp. for the actuating mechanism. These values are for only short intervals of time.

Friday's failure



MAKES GUN MOUNTS ON TUESDAY

FRIDAY THE THIRTEENTH, 9:00 A.M., ARMATURE FAILED IN 1500 AMP. MULTIPLE-OPERATOR WELDER. LOST PRODUCTION FOR 15 MEN. WELDER DELIVERED TO WESTINGHOUSE DISTRICT MANUFACTURING AND REPAIR PLANT. NEW COILS FORMED, INSULATED AND TREATED. ARMATURE REWOUND. NEW EQUALIZER MADE AND INSTALLED. TURNED AND POLISHED COMMUTATOR. TUESDAY, THE SEVENTEENTH, 8:00 A.M., BACK ON THE JOB TO MAKE GUN MOUNTS FOR SMACKING THE AXIS.

Westinghouse

DISTRICT MANUFACTURING AND REPAIR

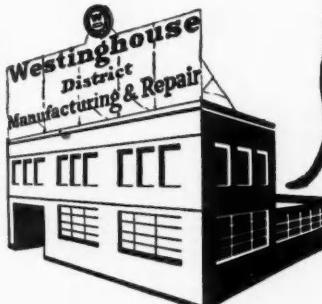
J 90463



IF THE EQUIPMENT NEEDING REPAIR IS VITAL TO THE WAR EFFORT... PHONE THE NEAREST OFFICE OF WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY FOR

EMERGENCY SERVICE

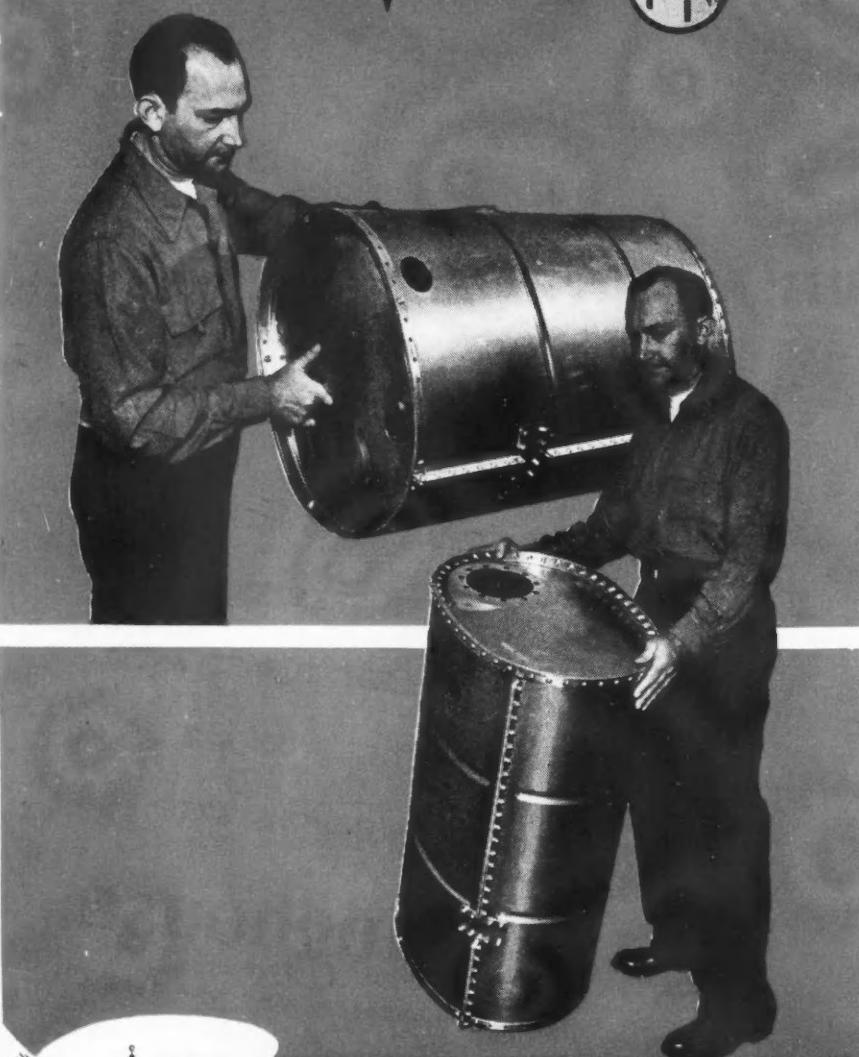
33 M & R PLANTS . . . ONE NEAR YOU!



LUBRICATING OIL CELLS

for *Giant Bombers*

(PN)



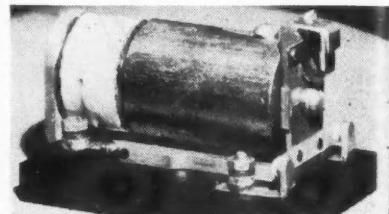
Poulsen
&
Nardon,
INC.
LOS ANGELES • CALIFORNIA

An override stop prevents the mechanism from over-counting regardless of the voltage or acceleration loads.

General Electric Time-Delay Relay

A new time-delay relay for aircraft applications where time-delay drop-out is required, has been announced by the General Electric Company, Schenectady, N. Y. It is available in two sizes, one providing up to 0.4 second time-delay, and the other up to 0.3 second time delay. On many applications, this relay can be used directly to control the desired device, while on others it may be desirable to have the relay actuate a contactor.

The new relay employs a familiar principle to accomplish the accurate time-delay it provides. This principle consists of delaying the decay of flux



General Electric Time-Delay Relay

in a magnetic circuit through the use of a single-turn, low resistance copper jacket around a section of the magnetic structure.

Designed for use in a range of ambient temperature from plus 95°C to minus 40°C, both sizes are compact, suitable for mounting in any position, and corrosion proof, withstanding 95 per cent humidity at 75°C on 48-hour tests and operating successfully immediately thereafter.

The normally closed, double-break, silver contacts of the relays will carry 20 amperes continuously at altitudes up to 40,000 feet above sea level. The operating coils can be furnished for operation on either a 12 or a 24-volt circuit.

Whether the relay is energized or de-energized, its contacts will remain in the correct position without chattering, even when subjected to mechanical frequencies of from 5 to 55 cycles per second at 1/32-inch amplitude, applied in any direction, or when subjected to linear acceleration of ten times gravity in any direction.

United Aircraft Corp. Outdoes Its Licensees

United Aircraft Corp. has announced that its Pratt & Whitney Division manufactured more aircraft engines in the approximately 13 months between Pearl Harbor, Dec. 7, 1941, and Jan. 1, 1943, than all of its licensees. This output totaled 50,000 engines, according to a previous announcement.



FORMED WHEEL GRINDING

For "high achievement in the production of war materiel", the men and women of GEARGRIND have received the highest recognition given by our armed forces. All four GEARGRIND factories are delivering constantly increasing volume of vital machinery and parts.

GEARGRIND Machines, for the Formed Wheel Grinding of external and internal gears, external and internal involute splines, straight splines, serrations and racks.

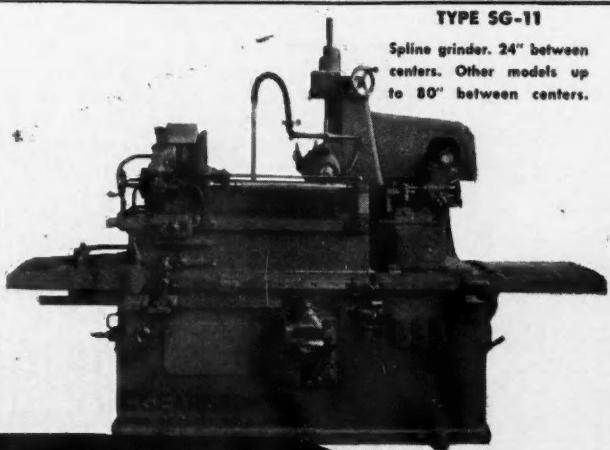
RZEPPE Constant Velocity Universal Joints used in America's jeeps, multiple wheel drive trucks and other military vehicles.

GEAR TRAINS, for directing the Navy's Bofors anti-aircraft guns.

CONTRACT GRINDING for manufacturers of war materiel requiring extreme tooth accuracy and high finish.

TYPE SG-11

Spline grinder. 24" between centers. Other models up to 80" between centers.



**GEAR GRINDING
MACHINE COMPANY**
DETROIT, MICH. U.S.A.

Origin of Supercharging

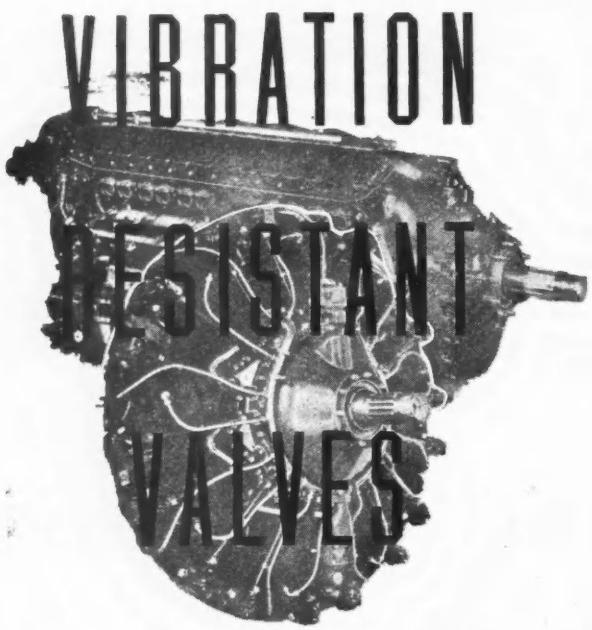
SUPERCHARGING dates back further in the history of the internal combustion engine than most people realize. Most of the earliest engines operated on the two-stroke cycle and had the charge compressed in an auxiliary cylinder. The Brayton engine, for instance, which was developed in Philadelphia about 1872, compressed the charge in an auxiliary cylinder to 5 atmospheres, and then transferred it to the working cylinder by way of an intermediate reservoir. The working cylinder, therefore, was pressure-charged, but that does not necessarily mean that it was supercharged, for charge was admitted to it during a part of the stroke only. In order to supercharge the working cylinder it would have been necessary for the auxiliary cylinder to have a materially greater displacement than the working cylinder, and the patent drawings of the Brayton engine do not indicate that it was intended to make the auxiliary cylinder larger than the working cylinder.

One of the first internal combustion engines used in a motor vehicle actually was supercharged, however. This was the Daimler two-cylinder narrow V engine brought out in 1889. The crankcase of the engine, which housed the two flywheels, served as supercharger or blower. Automatic inlet (or transfer) valves were located in the piston crowns. The crankcase, acting as a charging pump, evidently had twice the displacement of each working cylinder, and theoretically at least the engine was supercharged. Renault in 1902 applied for a patent covering the use of the radiator fan as a supercharger. During the same year the Premier Gas Engine Company in Nottingham, England, brought out a four-stroke engine with two single-acting working cylinders arranged in tandem, the two pistons being connected to a crosshead on which was mounted the piston of a piston-type blower or scavenging pump. Junkers in 1906 carried out experiments with a rotary blower applied to one of his two-stroke compound engines. It was reported at the time that the initial pressure in the high-pressure cylinder was about 180 psi, the end pressure about 1300 psi, and the maximum combustion pressure between 3000 and 3750 psi with gaseous fuel, and about 1750 psi with oil.

A sliding-vane type of rotary blower was suggested for four-stroke engines by Grubler in Switzerland in 1906. The blower delivered to the working cylinder through a line connected near the bottom of the stroke. A positively-operated slide valve shut off the line from the cylinder during the latter part of the power and the first part of the exhaust stroke, and there was communication between the blower and cylinder only during the latter part of the inlet and the first part of the compression stroke. Grubler intended the blower to make up for the loss of power with increase in altitude, which probably was often painfully apparent on the mountain roads of Switzerland during those pioneer days with its low-powered engines. He figured it was not necessary to supply extra gasoline with the air from the blower, since the charge supplied by a carburetor naturally tends to become overrich with increase in altitude. Zoller in Switzerland in 1911 applied for a patent on an aircraft engine with three cylinders arranged in fan form (a W engine) in which a dual centrifugal blower was mounted on the crankshaft.

Supercharged aircraft engines came into use toward the end of World War I. The Germans used multi-stage centrifugal blowers, sometimes driven by a separate engine, while in France, Rateau, a specialist in steam turbines and centrifugal blowers, developed the turbo blower comprising a gas turbine operated by the exhaust, and a direct-connected centrifugal blower furnishing air to the cylinders. Work along this same line was taken up in this country by the General Electric Company under the direction of Dr. Sanford A. Moss.

Superchargers made their first appearance in the Indianapolis race in 1923, when the Mercedes team of three cars were equipped with them. The race that year, how-



FOR ENGINE MOUNTING GENERAL CONTROLS

hi-g
TRADE MARK

ELECTRIC VALVES



One of the most important and valuable characteristic of all General Controls electromagnetic valves is their ability to operate in any position, regardless of vibration, acceleration or change of motion.

Because they are vibration-resistant, General Controls valves can be installed where they are best suited from a utility standpoint. Because they are vibration-resistant, they can be engine mounted, simplifying plumbing, saving materials, saving space, saving weight, saving time, saving money.

Fast acting and light in weight (the Type AV-1 Valve illustrated above weighs but 8½ ounces!) these valves are designed for various automatic and remote control requirements. They are available in more than a score of types, handling aromatic or domestic gasolines or vapors, air, hydraulic oil, anti-icing fluids and lubricating oils, and pressures up to 3000 lbs. or more. Write or wire today for engineering data and Descriptive Bulletin.

GENERAL CONTROLS

PIONEERS AND LEADERS IN THE DEVELOPMENT
AND MANUFACTURE OF MAGNETIC VALVES
801 ALLEN AVENUE, GLENDALE, CALIFORNIA
BOSTON • NEW YORK • PHILADELPHIA • SAN FRANCISCO
DETROIT • CHICAGO • CLEVELAND • DALLAS • DENVER

ever, was won by a non-supercharged H. C. S. car. The following year the Duesenberg entries were supercharged, and they won the race. Duesenberg also was the first to offer an American-built supercharged stock car.

New Dardelet Thread

A NEW form of thread for studs to be used in aluminum has been devised by the Dardelet Threadlock Corp. of Detroit. It conforms to the American National thread (AN) and is known as the American National Dardelet (AND). Comparative tensile tests on $\frac{1}{8}$ -in. studs with 24-pitch AN and 16-pitch AND threads respectively are said to have shown the latter to possess an 8-per cent higher tensile strength, while the fatigue life or endurance is increased much more.

Studs in aluminum are made an interference fit. In the sketch herewith are shown sections of AN and AND threads. The cross-sectioned surfaces represent interference, and the black surfaces voids toward which the light metal affected by the interference can flow. It will be seen that with the AN thread there is interference on the thread flanks, and the metal must flow toward the void

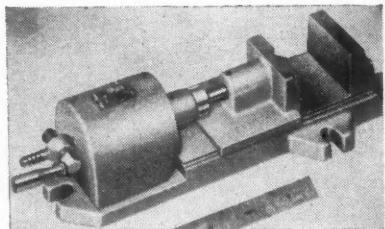


at the root of the thread in the aluminum. With the AND thread, on the other hand, there is interference at the crest of the stud thread, and a void toward which the metal affected by this interference can flow is provided between flanks. To aid this flow, the crest of the stud thread is inclined 6 deg.

In an endurance test made on aluminum parts fitted together with AND-threaded studs, an interference of 0.003 in. was allowed between the root of the stud and the crest of the tapered crest of the thread. Voids of 0.002 in. were allowed between flanks. When the parts were assembled, maximum interference resulted where the stud emerged from the metal, as the stud thread root was tapered down 0.003 in. toward the end. With the AND thread the metal at the root of the thread in the aluminum is compressed, and the effect is said to be the opposite of that with the NA thread, which tends to wedge and split the sharp root of the thread and cause fatigue cracks.

The Mead Air Vise

THE Model 42 Mead Air Vise, a recent development of the Mead Specialties Company, Chicago, Ill. Two jaw settings are provided, the smaller setting gives a nominal opening from zero to 2 in. and the larger setting pro-



vides an opening from $1\frac{1}{8}$ in. to $3\frac{3}{8}$ in. The stroke may be shortened to any desired length by means of a collar on the ram. Lugs are provided at both ends of the vise, as well as at both sides.

**SEE
"AEROSCREW"
FOR...**

**STEEL DRILLED HEAD
AIRCRAFT BOLTS**

Generally known as "Engine Bolts" and widely used in aircraft construction where bolts with heads drilled to accommodate lock wire are required. Holes drilled through all faces to meet center hole in top of hexagon head. Made of heat-treated nickel steel to conform with Army-Navy specifications, in types AN73 through AN81 and sizes up to 6" length. Also in coarse thread (NC3) or fine thread (NF3) styles. Carefully inspected and tested for quality, accuracy, and uniformity. Cadmium plating conforms to AN-QQ-P-421. Identified by "X" on head.

**DRILLED FILLISTER HEAD
MACHINE SCREWS**

Used in many assembly operations and hence available in several types and a wide range of sizes. Low-carbon screws, for ordinary uses where high strength and close tolerances are not required, made to Air Force drawings AC500A and AC501A. Heat-treated nickel steel screws, for more particular applications where screws are appreciably stressed, conform to Army-Navy drawings AN502 and AC503. For close positions, where double cross-drilling is desirable, nickel steel screws conform to Navy drawing NAF-1164. Plating is bright and uniform. Nickel steel items identified by "X" on head.

We are Specialists . . .

in the manufacture of selected items of aircraft hardware. In addition to the above, we can furnish high-quality Hexagon Head Bolts, Clevis Bolts and Pins, Washer Head Screws, and Threaded Taper Pins.

Write for Catalog and Engineering Data

AERO SCREW COMPANY

19th Ave. at 12th St., Rockford, Illinois

New German Warplane

(Continued from page 33)

Ju 86P and aircraft of this type are known to have been flown over England and North Africa. There are two versions of the Ju 86P, the P-1 being a bomber with a maximum load of 2200 lb and the P-2 a long-range reconnaissance machine carrying three cameras.

The British Air Ministry states that the principal modifications incorporated are increased wing span, the fitting of a pressure cabin, installation of turbo-supercharged Diesel engines,

reduction of crew to two (pilot and wireless operator) and the elimination of armament. The engines are the Junkers Jumo 207A (opposed piston) type, a high-altitude version of the Jumo commercial aircraft engine.

BV 222 Flying Boat

The third new German machine is the Blohm and Voss BV 222 six-engined flying boat, the primary function of which is the transport of freight and personnel. It has six BMW 1000-hp

radial engines along the leading edge of the wing, as shown in the accompanying general arrangement drawings. It is said to have been designed originally for the *Lufthansa* (for trans-Atlantic civilian passenger and freight service) but has lately been adopted as a German military machine for freight and troops.

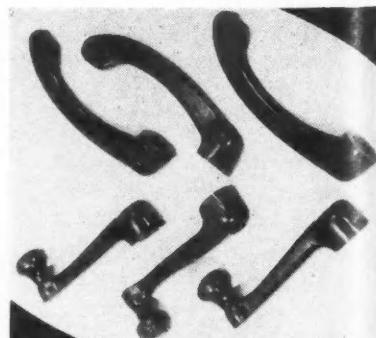
The cantilever wing has a span of 150 ft. The lateral stabilizing floats are partially retractable. Powered armament is installed. No information is available as to load capacity, but it is believed that the maximum speed is around 200 mph with a maximum range of about 4000 miles. From neutral sources the gross weight is reported to be a little under 100,000 lb.

DB 606 Double Engine

As regards the Daimler-Benz dual engine used in the He 177 bomber, this is known as the DB 606 and is a combination of two DB 601 engines mounted side by side and driving a single propeller. The British Air Ministry states that reports that an engine of this type has been applied to a Messerschmitt fighter termed the Me 115 are inaccurate, as no aircraft of such a designation exists; 115 is a Heinkel number.

Some time ago the Daimler-Benz Co. published a sketch (see illustration) showing two engines mounted in combination for driving a propeller. The drive from the two engines, A, is through over-running clutches, B, and reduction gear pinions, C, which mesh with a gear, D, on the tubular propeller shaft, E. The propeller is of the two-bladed type with the blades adjustable about offset pivots, F, to vary the pitch. Such adjustment is effected by means of links, G, connected to a cross-head on the end of an axially movable stem which is screw-threaded into the end of the co-axial pitch control shaft, H. Secured to the end of the control shaft is a pinion, J, meshing with the output wheel of a governing device, K, which is driven by a pinion, L, secured to the hollow propeller shaft.

Handles Molded of Lumarith



These Chevrolet door handles and window regulator handles are molded of Lumarith, a product of Celanese Celluloid Corporation, New York, N. Y. They will not chip, warp or corrode. A special formula renders them impervious to ultra violet rays, and metal cores add to their strength.

Stability
ESSENTIAL IN
DEGREASING SOLVENTS

IS HIGHEST
IN
Perm-A-Clor

Uninterrupted cleaning is assured in
War Plants using Perm-A-Clor Solvent.

The difficulties encountered in the use of ordinary solvents under varying operating conditions were overcome when Detroit Rex Engineers originated the stabilization of chlorinated solvents.

High stability is our creed! That's why Perm-A-Clor is the most highly stabilized chlorinated solvent available. It will outperform all others under adverse conditions of light, heat, moisture, and mixtures of different metals, which cause the disintegration of lesser stabilized solvents.

Not only is Perm-A-Clor more stable as a liquid, but it also remains stable as a vapor and condensate.

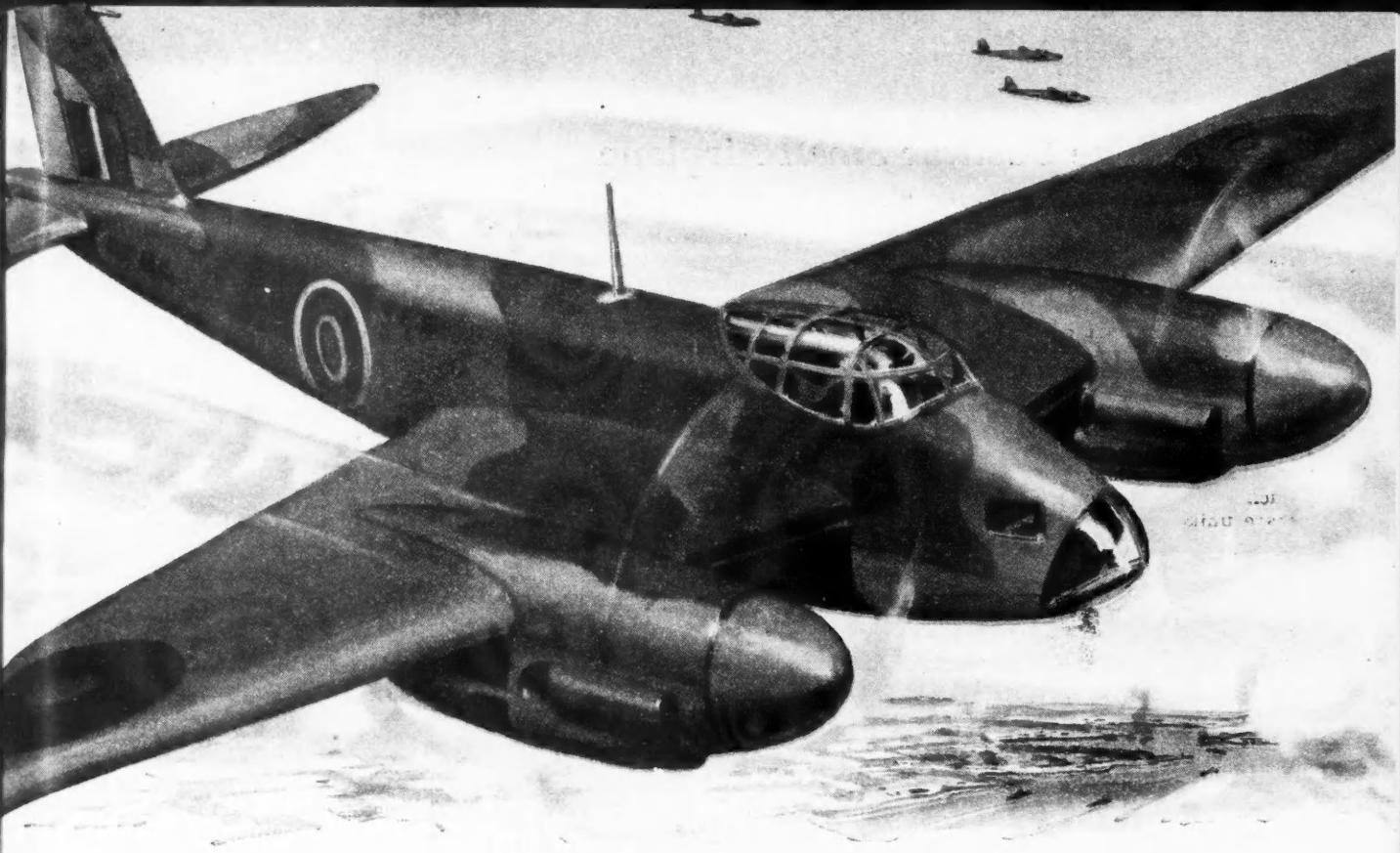
Another Detrex solvent, Triad, is widely used for less rigorous cleaning operations, especially where only steel parts are to be cleaned. It has the same excellent cleaning qualities of Perm-A-Clor but differs in the kind and amount of stabilizer. You can choose the Detrex solvent suited to your particular cleaning operations.

SOLVENT DEGREASING and ALKALI CLEANING

DETROIT REX PRODUCTS COMPANY

13001 HILLVIEW AVENUE • DETROIT, MICHIGAN

Branch Offices in Principal Cities of U. S. A. — In Canada: Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario



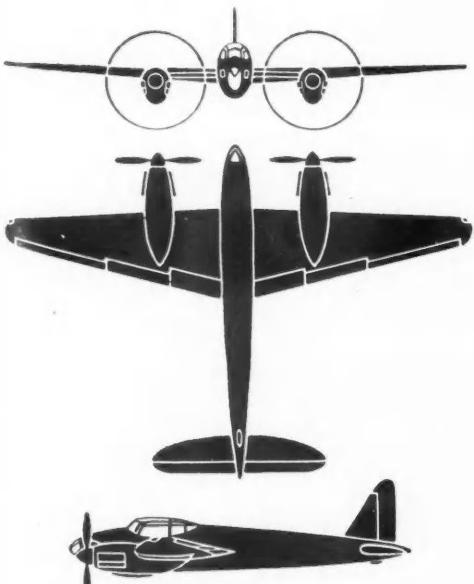
MOSQUITOES MOVE THE MAIL TO MALTA

Every day, twin-engined high-speed Mosquitoes streak across Europe between England and Malta so fast they're out of sight before interception is possible. Flights aren't scheduled nor

do they take regular scenic routes yet they're plenty exciting!

The tales these Mosquito pilots will tell after V-Day will be more thrilling than any ever told by pioneer pony-express riders of the western plains. Fastest bomber in the world, the de Havilland Mosquito, like many other combat-proven aircraft now being built in Canada, is ADEL-equipped.

ADEL PRECISION PRODUCTS CORP.
BURBANK, CALIFORNIA

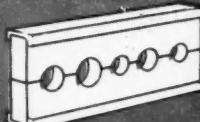


de Havilland Mosquito

**SPOT THIS PLANE AND YOU'LL
SPOT ADEL EQUIPMENT!**

FLYING TO VICTORY WITH THE GREATEST NAMES IN AVIATION: Beech, Bell, Boeing, Brewster, Consolidated, Curtiss-Wright, Douglas, G. & A., Grumman, Lockheed, Martin, McDonnell, North American, Northrop, Republic, Ryan, Timm, Vega, Chance Vought, Vultee, Waco. In Canada: Boeing, Canadian Car & Foundry, Canadian Vickers, de Havilland, Fairchild, Federal Aircraft, MacDonald Bros., Victory Aircraft, Noorduyn Aviation, Limited

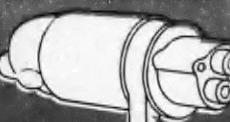
Dual Purpose Line Support Block



ADEL Line Support Clip



ADEL Anti-Icing Pump, Series 1



ENGINEERING SERVICE OFFICES: DALLAS, TEX. • DETROIT, MICH.
HUNTINGTON, W. VA. • HAGERSTOWN, MD. • TORONTO, CAN.

BUY BONDS FOR VICTORY!

The Postwar Small Airplane

(Continued from page 21)

type of construction is rapidly finding its way into the bigger engines up to 8 cylinders and over 200 hp. The cost of the engine and its accessories represents a major part of the cost of the airplane. Any decrease in this cost results in a favorable improvement in the possibilities of increased sales. The engine is essentially a machine tool production project, and in projects of this kind the most important factor in reducing the cost per unit is to build more units on the same equipment. A

good example of this is the automobile engine, in comparison with similar construction in the marine engine. In the prewar period even the small four-cylinder aircraft engine cost about five dollars per horsepower, whereas, the automobile engine cost less than one dollar per horsepower. To obtain lower costs for the powerplant may mean that the engine manufacturer will have to take some risk on the number of units he produces and build in larger production quantities, in anticipation

of larger sales. The lower price will of course create these sales. The airplane manufacturer will also have to share in this risk and place larger orders with the engine plant. This may sound like a vicious circle but it is one of the few ways available to produce lower costs.

Lower cost and greater utility go hand in hand. One useful way to compare cost, and one of the factors of utility, is to analyze them on the basis of useful load. To illustrate this point compare the range of cost per pound for the series or airplanes shown in Fig. 5. The difference between the cost in the lower power range to that of the higher is again to be noted. By additional comparison with Fig. 6, and other data on quantities produced, the effect of increased production becomes evident. Another useful chart on cost comparison is shown in Fig. 7. This chart shows the relationship of cost per pound of empty weight (cost of fabrication and material plus overhead), to quantity and manufacturer.

These cost data are based on list prices, but since the distributors discounts are uniform for practically all of the industry, the list price forms a good and ready means of comparison. In nearly all the cases the lowest cost represents the largest production.

Discussion about the section of the country in which pilots and airplanes are most numerous is heard frequently. To supply information on this subject we present Fig. 8. In this illustration the distribution of certificated airplanes at the beginning of 1942 is shown for various sections of the country. The table accompanying the map lists the number of pilots, airplanes and their ratio for each state. Another good comparison with this chart would be to show the distribution of population and such products as automobiles, washing machines and others. The all-year weather conditions and airport facilities will also be found to be an important contributing factor. As the cost of airplane operation is reduced, the distance between points of travel such as exist in many of the less populated states, will increase the utility of the airplane and its use. These states, therefore, offer good sales possibilities.

As the Fly-A-Plane-Car Services develop and flying facilities and flying popularity increase, we will see other types of aircraft take their due place. These will no doubt include roadable or convertible car-plane types, helicopters and other new developments, each of which are now receiving much careful thought.

Supplementing this use of the airplane, we will have the private owner who flies for sport or who does sufficient flying to warrant the extra cost of owning his own airplane. In addition there will be airplanes owned by companies for their personnel, airplanes for flying clubs and schools, and other uses.

Any careful analysis will show a bright future for the private owner

Need Gauges in a Hurry?

Here is how to order
them for Fast Delivery



1 & 2 STANDARD PLUG AND RING GAUGES

(1) Diameter. (2) Length of gauging surfaces.
(3) Tolerance or accuracy. (4) Hardened alloy steel or chrome. (5) No. of Members Go, Not Go, Handles (for plugs only). (6) Complete marking instructions. (7) Date that percentage of total order must be received.

3 SNAP GAUGES

Send complete specifications and blueprints and definite date order must be received.

4 FLUSH PIN

Send complete specifications and blueprints and definite date order must be received.

5 BUILD UP

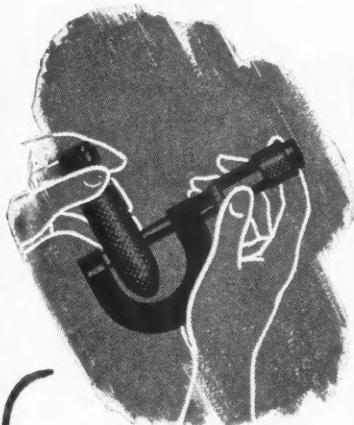
Send complete specifications and blueprints and definite date order must be received.

ENGINEERS: In designing plug and ring gauges bear in mind that standard lengths will speed up the delivery of your gauges.



TURNER GAUGE GRINDING COMPANY
2622 HILTON ROAD • • • • FERNDALE, MICH.

FUEL LINE STRAINERS built with BOMB-SIGHT PRECISION...



*...Exceptionally
close tolerances*

*and deep drawing accomplished
through use of Monel wire cloth*

Proof of the excellent fabricating qualities of Monel wire cloth are these strainers for use in military aircraft. Consider the strict requirements of this application:

The wire cloth employed must resist abrasion,

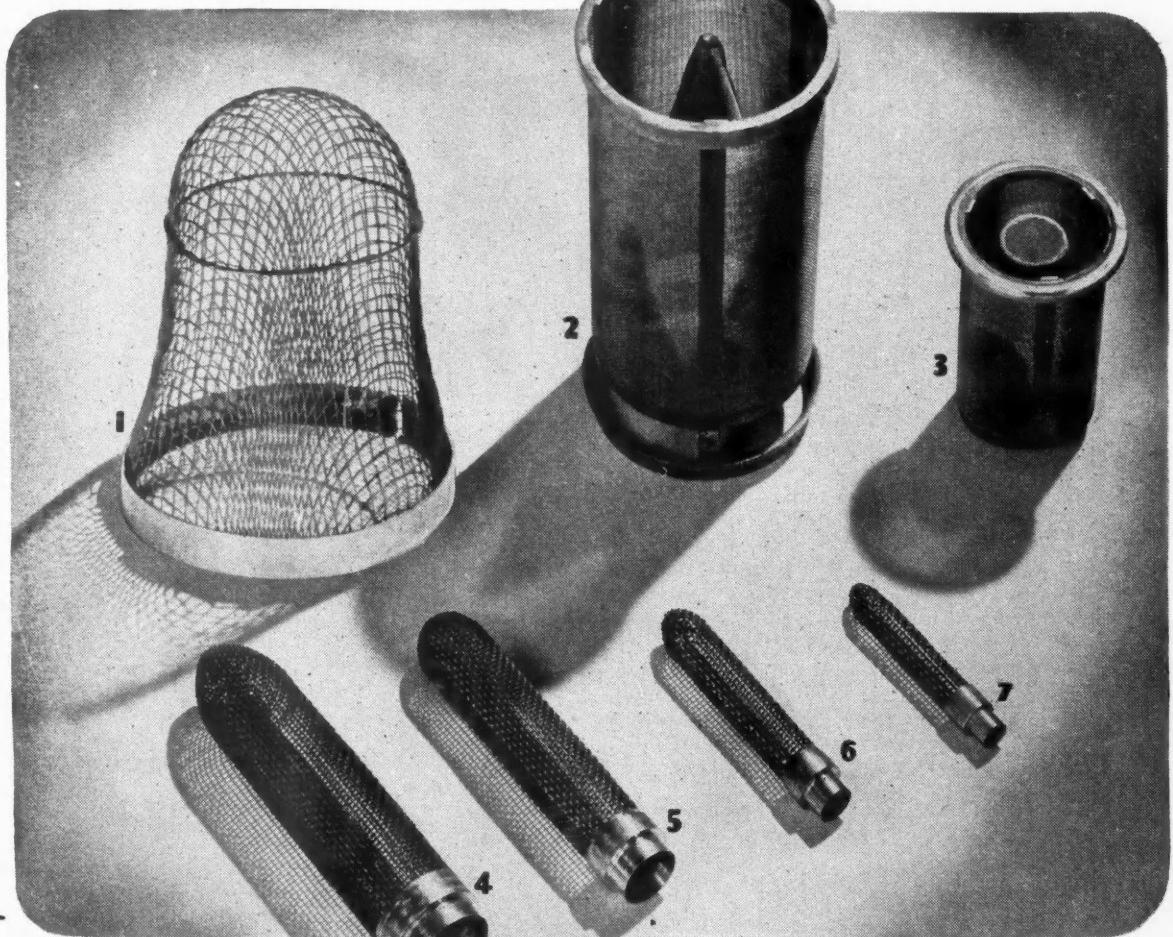
corrosion, wear and abuse. In addition, the strainers must be fabricated to tolerances as exacting as plus .0 inch, minus .001 inch. One of the strainers, for fuel tank inlet, is produced by a five inch deep draw!

Such results are obtained with Monel owing to its unique combination of high physical properties, fabricability and weldability. Its high strength, stiffness and ductility assure uniformly woven cloth, and proper forming. Its weldability permits simplicity of design and speed in fabrication. Together these factors permit the Michigan Wire Cloth Co. to turn out the precision made strainers required by aircraft.

THE INTERNATIONAL NICKEL COMPANY, INC. • 67 WALL STREET, NEW YORK, N. Y.

MONEL 

"Monel" is a registered trade-mark of The International Nickel Company, Inc., which is applied to a nickel alloy containing approximately two-thirds nickel and one-third copper.



1.
Fuel Tank Inlet Strainer made from 5 mesh, .023" diameter wire Monel wire cloth, with brass reinforcements.

2.
Fuel Line Strainer made from 60x50 mesh, .008" diameter wire Monel wire cloth, with brass ring and flange and phosphor bronze reinforcement strips.

3.
Fuel Line Strainer made from 60x50 mesh, .008" diameter wire Monel wire cloth, with brass flange and collar reinforcement.

4. to 7.
Finger Strainers for Gas Tank Outlet. Made from 18 mesh, .018" diameter wire Monel wire cloth, with brass ferrules and collars.

type of aircraft, provided the UTILITY is improved. Progress and growth will be slow at first, but volume will steadily increase until the business becomes one of the leading enterprises in the field of transportation.

Buick Method for Making Steel Cartridge Cases

(Continued from page 39)

ter operation. It is limited to a depth of about 2 in. at the mouth end with the temperature controlled closely. The tapering operations are considered the most critical of all steps, Mr. Schenck

points out, because in these two press operations the cold steel must be made to flow into the desired taper without wrinkling or distortion and without the support of a punch on the inside. The

case is simply forced up into a tapered die cavity in two stages both on the same press. The second stage does have a punch which extends about 3½ in. into the case. This is required not for the overall taper, but to support the metal in forming the reduced section at the mouth.

Punches used on all the cold drawing and tapering operations are made of hardened high speed steel and chromium plated to improve the wearing qualities and to provide better anti-frictional properties. Lower dies in the cold operations are generally steel rings with cemented-tungsten carbide inserts on the working surfaces.

After the tapering operations the mouth end becomes appreciably harder because of the cold working, so it is annealed once more this time to a depth of about 3½ in. from the open end. This softens up the mouth and assures complete obturation in firing, that is, a tight seal in the gun barrel to prevent the explosion from blowing back into the breech.

The cases are inspected and transferred to Lodge & Shipley automatic lathes which face the head, rough form the flange, finish form the flange and drill the primer hole. These lathes have five stations, four for the machining operations and one for loading and unloading. Reaming and counterboring the primer hole are performed on vertical machines and great care must be exercised in these operations since specified tolerances are unusually close.

Final stress relieving is performed in a batch type electric furnace accommodating 316 cases. This heat treatment adds roughly 10,000 psi to the yield and ultimate strength of the case.

Before final acceptance by Ordnance there are a wide range of inspections. One unusual type of inspection tool has been developed to permit close observation of the interior wall of the case. A cone-shaped piece of steel slightly smaller in diameter than the case is chromium plated to a mirror finish on the outer surface of the cone. A wire is attached to the apex of the cone and a small light arranged to illuminate the interior of the case and the bright surface of the cone. The unit is lowered to the base of a case and drawn slowly upward while the inspector watches the mirror surface. The inner surface of the case is reflected in magnified form so that any surface defects are readily observed.

SARAN*
The New Name to
Check When You Need TUBING

A practical new solution to the problem of replacing strategic metals and rubber for tubing is afforded by SARAN. That this remarkable new thermoplastic tubing can do the job—and do it well—is evidenced by its many current applications throughout industry. SARAN withstands high and low pressures, and temperatures to 175° F. It has great resistance to acids, alkalies, brine and other corrosive chemicals, comes in various sizes with matching plastic SARAN fittings. Let our experienced engineers work with your plant men to find where SARAN can do a job for you. Write us today.

WESTERN FELT WORKS
Acadia Synthetic Products Division
Chicago, Ill.: 4035-4117 Ogden Ave.
Detroit, Mich.: 420 Stephenson Blvd.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

TUBING
FITTINGS
PIPE
PIPE FITTINGS
SHEETS
MOLDED PARTS

LICENSEE OF THE
Dow Chemical Co.

ACADIA
Processors of
Synthetic Rubber and Plastics •
Sheets • Extrusions • Molded Parts
Synthetic
PRODUCTS

Climax Interests Buy McAlear Co.

Ownership of McAlear Manufacturing Company, Chicago, producer of valves, regulating and control equipment, was acquired by the interests controlling Climax Engineering Company, manufacturer of internal combustion engines, power units and generating sets, it was disclosed at the Climax home office in Clinton, Iowa.

IT BETTER BE NEW— AND NEWS

This is new. And it's NEWS for every post-war planner. World's largest fractionating tower. It's all-welded. Sets a NEW high in fit-up tolerances and fractionating efficiency—a NEW low in oil refining cost.

ALTER EGO: Yes—and a NEW high in construction savings. Tower shell costs 30.7% less, weighs 15% less. Trays cost 30% less, weigh 54% less—because of arc welded construction.

That's the post-war pattern! The NEW product must be a better product at less cost. Be it vacuum tower or vacuum cleaner the NEW product must obsolete the old models. Otherwise it's a sales dud.

ALTER EGO: Right! To build metal products that will win post-war sales we've got to think about how WELDING is now building the ADVANCED fighting equipment for winning the war.

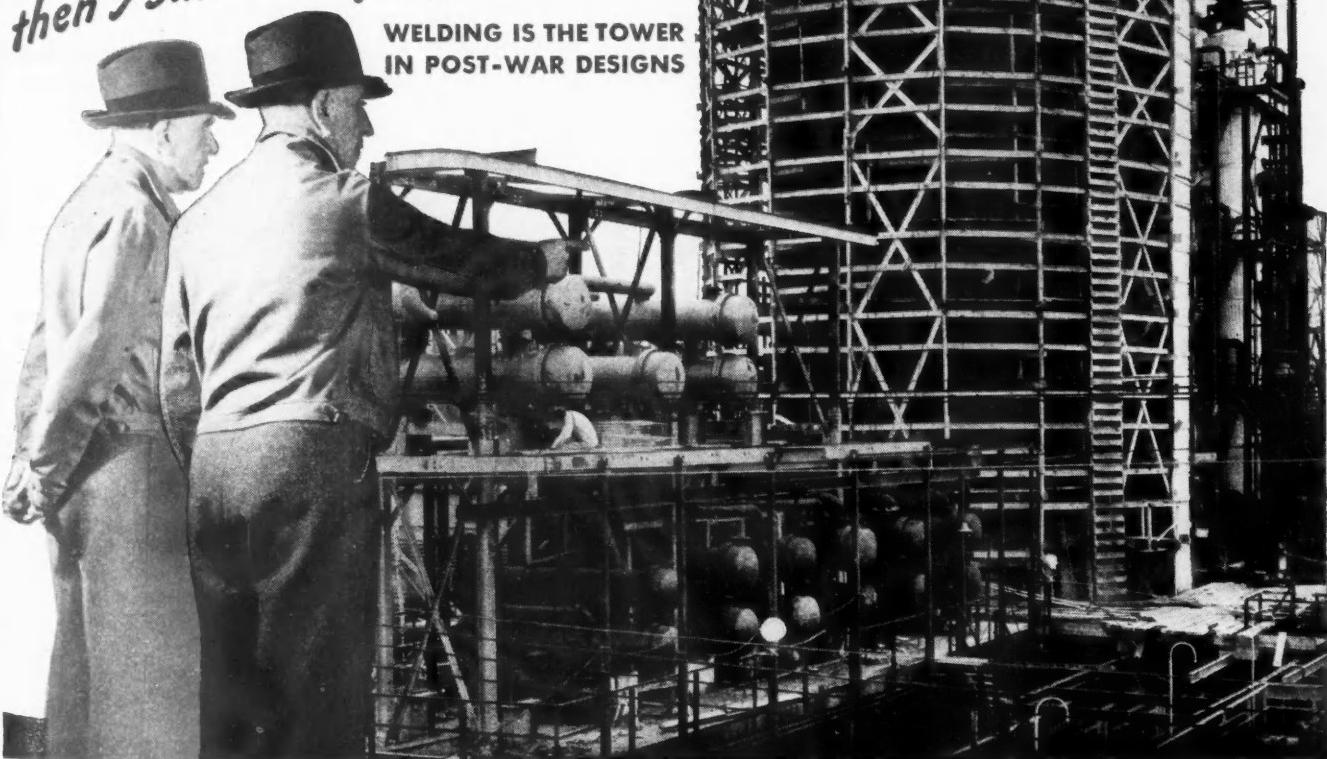
That IS something to start this post-war thought: Since we will have to fight WITH or AGAINST new models, let's plan the NEW by finding out from Lincoln what's NEW in arc welding—and how to apply it.

Ask your inner self whether old models will SELL after the war.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

WELDING IS THE TOWER
IN POST-WAR DESIGNS



New Production Equipment

(Continued from page 42)

rent control box which simplifies the installation. The counter is capable of checking or determining the effective turns of coils ranging from 1 to 11,110 turns, at a rate of from 80 to 100 coils of like specifications per hour.

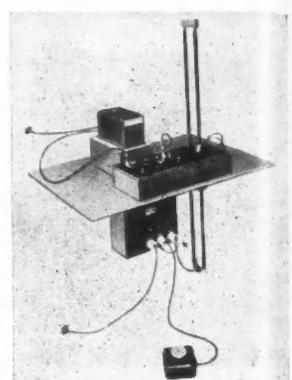
In addition to the magnetizing current control box, the coil-turn counter comprises a portable light-beam galvanometer, two yoked test rods, a galvanometer control panel, and a foot-

operated switch—all assembled for operation on a table or bench.

The reference coils of the new counter are enclosed in the galvanometer control case while the test rods are mounted on the case. This arrangement allows the coil to rest close to the reference coil with which it is compared.

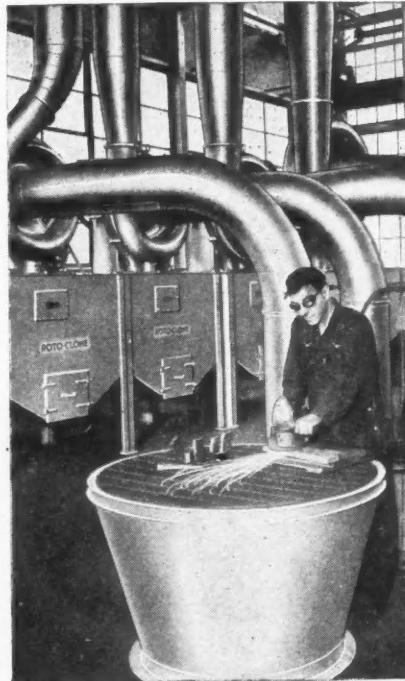
The use of a magnetizing current control box with the new counter simplifies installation since no additional wiring is required. All that is neces-

General Electric
Coil-Turn
Counter



COLLECTING PORTABLE GRINDER DUST WITH DOWN DRAFT EXHAUST BENCHES SERVED BY ROTO-CLONES!

Roto-Clone down draft exhaust arrangements such as are in use in the Cincinnati Bickford Tool Company's finishing department are in wide use for collecting fine portable grinder dusts. Generated dust is pulled downward from the grinding tools through the gridded bench tops and conveyed through ducts in underfloor pipe trenches to the Roto-Clone precipitators. These units may be conveniently located in unused space anywhere in the work room. Benches are available in a wide range of sizes and designs.

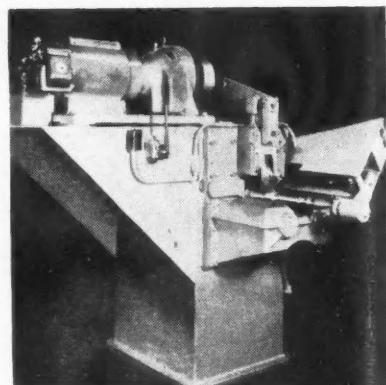


Complete information on the application of Roto-Clone to all types of industrial dust control is available without obligation. Send for free Bulletins.

sary is to plug in the connecting cord of the box. The magnetizing circuit is designed to operate from a 120-volt direct-current supply when used with a resistor furnished as part of the control box, or from a 20-volt storage battery without a resistor.

The accuracy of the counter is said to be one turn in a thousand for coils having air cores at least $\frac{5}{8}$ inch in diameter, an outside diameter of 8 inches and less, a coil build-up to 2% inches, and up to 6 inches in height. Accuracy is not as high for coils outside these limits.

A SHELL trimmer, for trimming the crop ends of shell forgings while still hot at the forge plant, has been placed on the market by The Yoder Company, Cleveland, Ohio. The shell is cropped at forging temperature, and the machine should be set in the forge line immediately following the final sizing operation. By means of an adjustment, shell forgings ranging in size



The Yoder Shell Trimmer

from the 60 mm trench mortar to the 155 mm high explosive shell can be cropped. The production rate is said to be 270 cuts per hour on 105 mm shells. Since it is possible to hold the bottom of the shell forging cavity against the end of the gaging mandrel during the cutting operation, the length can be held to close tolerances.

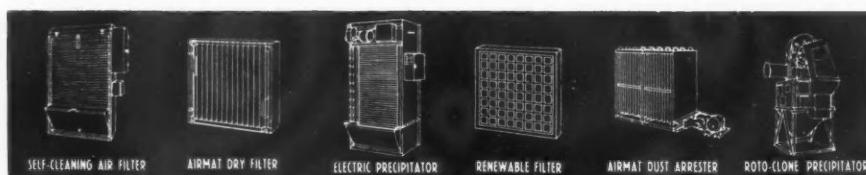
In operation, the hot forging is slid from the conveyor over the mandrel, and the start button is pressed to start



AMERICAN AIR FILTER CO., INC.

INCORPORATED

449 CENTRAL AVENUE LOUISVILLE, KENTUCKY
IN CANADA: DARLING BROS., LTD., MONTREAL, P. Q.



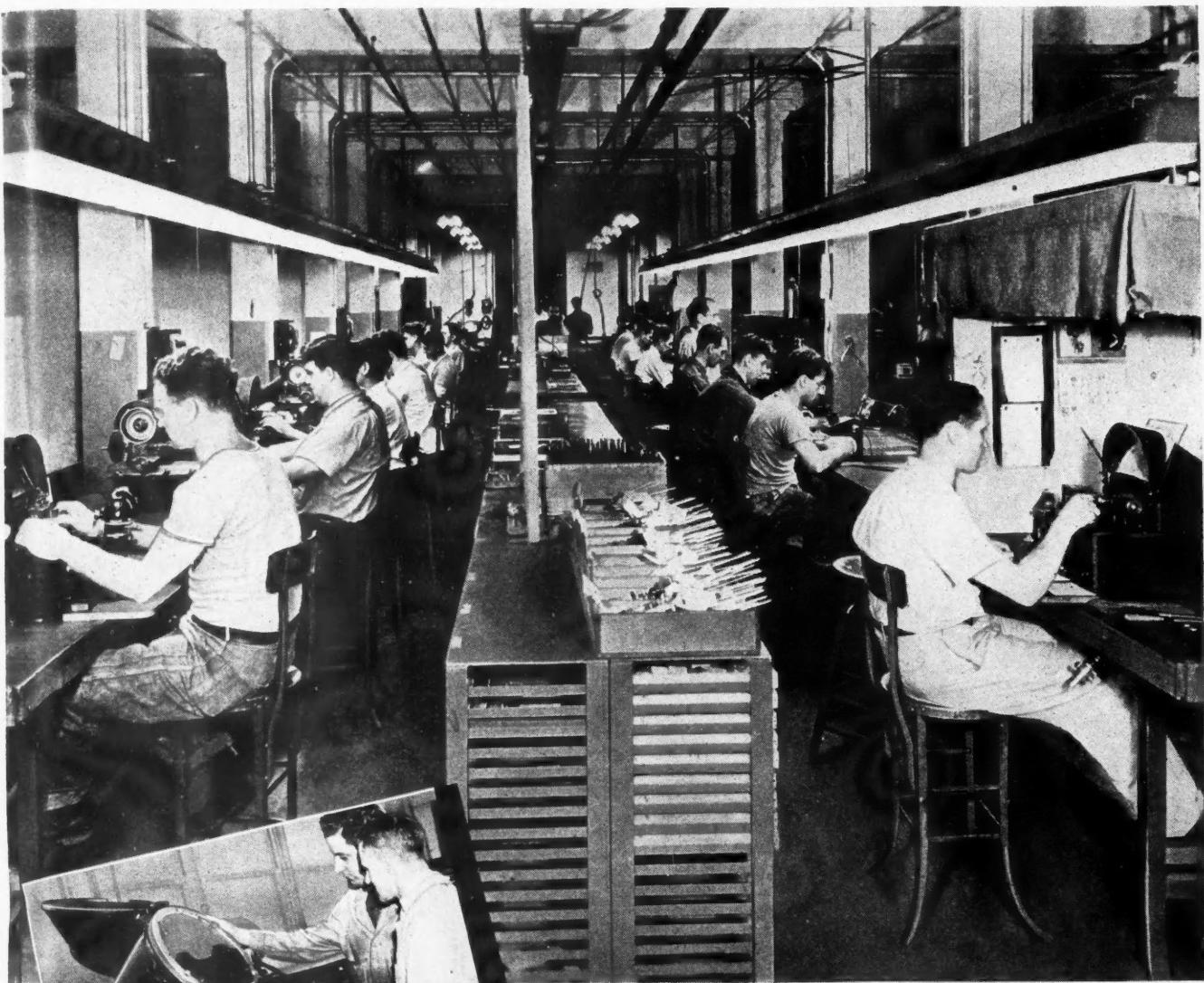


Photo Courtesy The Eastern Machine Screw Corp.

Modern inspection by optical projection saves time and money

Jones & Lamson Comparators are available in Pedestal, Bench and other types to meet every need in the field of Inspection by Optical Projection. We shall be pleased to study your problems and apply to them the accumulated experience of more than twenty years in this field.



Profit-Producing **Machine Tools**

JONES & LAMSON MACHINE COMPANY

SPRINGFIELD, VERMONT, U. S. A.

Manufacturers of: Ram and Saddle Type Universal Turret Lathes · Fay Automatic Lathes · Automatic Thread Grinders · Optical Comparators · Automatic Opening Threading Dies and Chasers.



the cycle. An air operated arm swings into position to hold the shell against the locating mandrel, which gages the shell length. While held in this position, the forging is rotated by the two driven rolls which support it, and the disk type cutter is fed automatically through the forging wall. On completion of the cut, the operator ejects the forging along with the cropped end, by actuating an air operated ejector.

THE Sturdimate Tool Company, Detroit, Mich., has designed a special live center for use in connection with thread grinding on an aircraft engine part. The center revolves with the



Special Sturdimate live center in use on a precision thread grinder.

part and prevents all movement between the center and the highly finished surface of the radius hole in the work. This eliminates all rubbing action, which would be especially undesirable

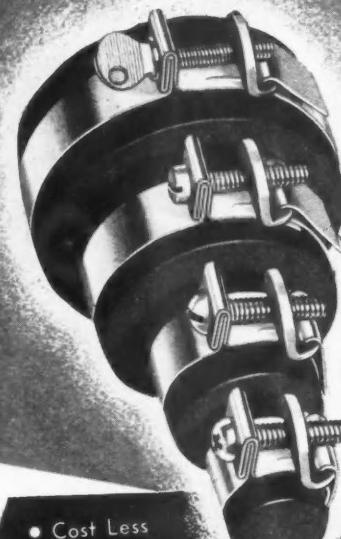
because of the emery in the coolant. It is said that the new center has eliminated all trouble, such as galling or deep scratching, which was encountered when dead or solid centers were used.

A NEW portable gasoline-driven generator for rapid battery charging is now in production at the Hunter-Hartman Corporation, St. Louis, Mo. It is designed to charge, 6, 12 or 24 volt batteries at 10 to 300 amps., and consists of a generator driven by a



Portable Gasoline Engine Driven Generator

IDEAL FOR ALL HOSE AND GENERAL CONNECTIONS



ALLSIZE UNIVERSAL HOSE CLAMPS

ARE

Completely Universal

- Cost Less
- Easiest to Use
- 100% Self-Locking

Approved Self-Locking Clamps that accommodate any range of diameter sizes.

Eliminate Your Production Bottleneck With ALL-SIZE CLAMPS.. Buy ONE Length —Replace 100 Different Preformed Clamps.

- A single All-Size Clamp will replace more than a hundred sizes of preformed clamps -- reducing your clamp inventory and assuring the right size clamp on hand when needed!
- This powerful, completely self-locking clamp has been tested and proved superior for both production and service work. It has sufficient take-up for use on synthetic rubber hose, and it can be installed around, or removed from, connected lines. It also is usable over and over again on either larger or smaller sizes.
- All-Size Clamps come flat in any length to fit any desired range of diameter sizes. They are acknowledged superior to the strongest clamps made -- but cost much less and are infinitely easier to use! . . .

If you now use clamps for hose or general connections learn how the ALL-SIZE Clamp can save time, labor and money for you!

ALLSIZE

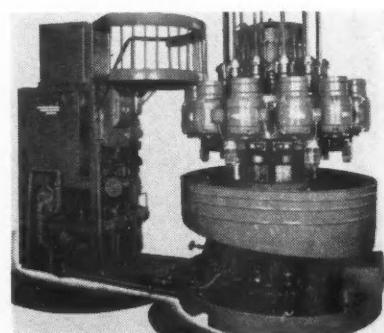
CENTRAL EQUIPMENT CO.
1018 SO. WABASH AVENUE * CHICAGO, ILLINOIS

SEND TODAY
FOR FREE
SAMPLES
AND PRICES

6 hp. single-cylinder, air-cooled, gasoline engine which is equipped with an air cleaner, gasoline filter, magneto, self-starter, rope starter, fuel tank and remote stop control. The unit is mounted on a skid-type base equipped with 5 in. wheels which may be raised to prevent creeping.

A TWELVE-spindle vertical-type automatic bar feed and chucking screw machine, known as the Eaglesfield Verti-Matic, is announced by The C. I. Togstad Company, Kokomo, Ind. While designed primarily for the production of parts from bar stock, it can be used for chucking operations within its capacity, as the weight of the parts in the long magazine tubes automatically discharges the finished pieces.

The Verti-Matic is composed of two units, the machine proper and the con-



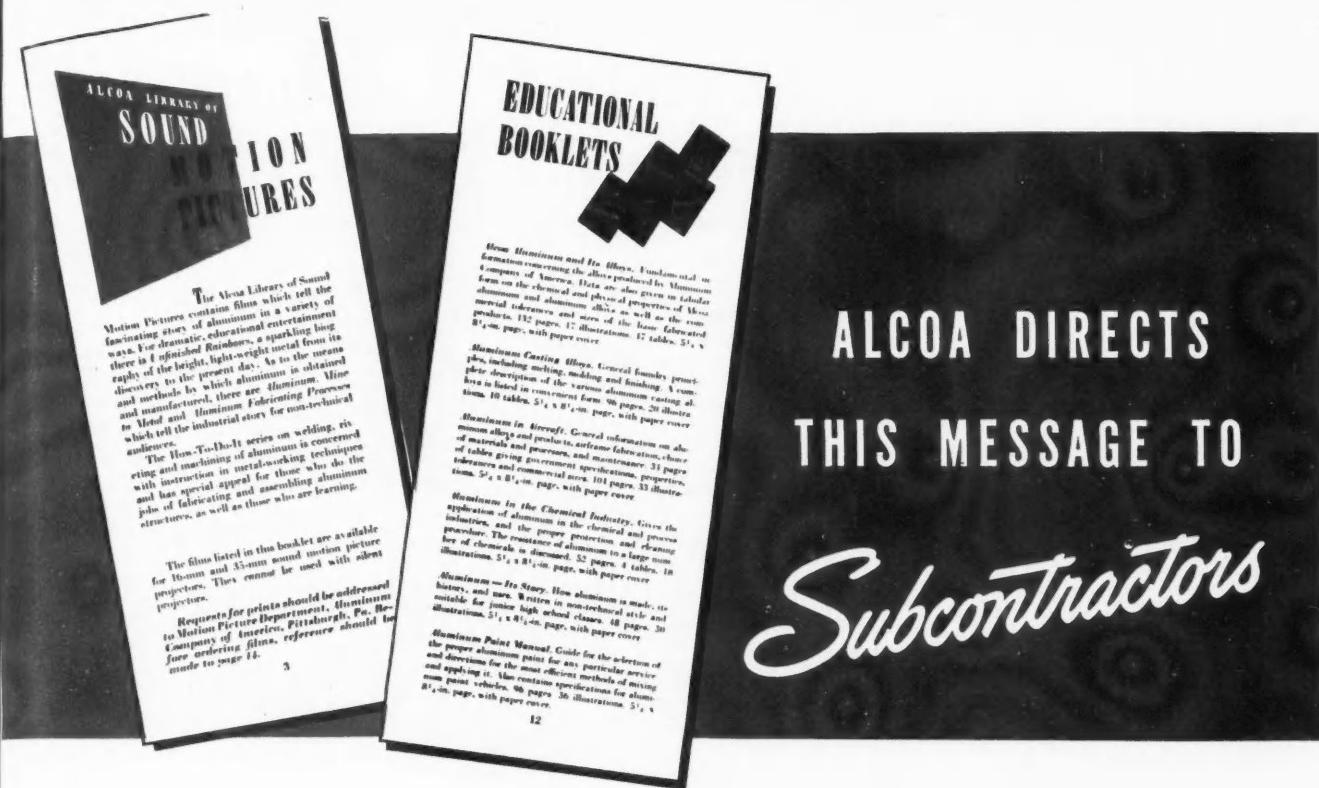
The Eaglesfield Verti-Matic

It
mi-
or
red

en-
ter-
Mo.
24
and
a

so-
an
to,
ank
is
ed
sed

to-
ng
es-
The
nd.
ro-
it
ns
of
bes
ed
wo
on-



12

Are you one of the many companies who are working on airplane subcontracts? It may be the first time you've worked with aluminum, and the job is strange to your workmen. You have received materials and specifications from your prime contractor, but you may need detailed information on some particular phase of the fabricating work.

Aluminum Company of America has prepared both literature and task-instruction motion pictures which are available to you. Often, this material will answer your questions adequately. In some cases, however, you

may require help on specific problems.

Alcoa engineers have spent a lifetime developing the best methods for fabricating aluminum alloys. Perhaps we've already helped some airplane builder solve the very problem that has you stymied. We're anxious to pass on all such information as will speed the war effort. Or, if it's a brand-new problem, we're ready to get going on that, too.

A letter or telephone call will start help on its way to you. Contact ALUMINUM COMPANY OF AMERICA, 2110 Gulf Bldg., Pittsburgh, Pennsylvania.

ALCOA ALUMINUM



trol unit. The machine proper consists of three main units; the base and column, the lower turret, and the upper turret. The base is a large cast iron pan with a supporting column running upward from the center. The column serves as a support for the rest of the machine. The lower turret, which houses the lower spindles with their respective drills, taps or cutting tools, is fastened to the column at a height convenient for the operator. This turret also carries the stock locator and the manifold supplying the cutting fluid. The upper turret is also mounted on the column, but is not fixed radially. It is allowed to rotate around the

column at desired intervals. Each of the twelve spindles is driven separately by a 2 hp. motor.

The Verti-Matic is operated entirely by hydraulic timing, which is adjusted by the setting of split cams to obtain timing desired. The camshaft is driven by an adjustable V-belt pulley, making it possible to obtain any timing cycle.

FOR position-welding long drums, tanks, and other heavy cylindrical pieces, the Ransome Machinery Company, Dunellen, N. J., offers the turning roll set illustrated.

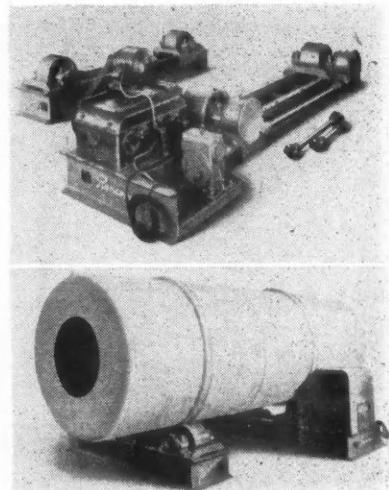
The set consists of a pair of motor-

FLYING STEEL

From Atlas in the Army and Navy's greatest bombers softens up the tough spots in Axis resistance and makes the way easier for Allied armies all over the world.

ATLAS DROP FORGE COMPANY
LANSING, MICHIGAN

ATLAS
DROP FORGINGS

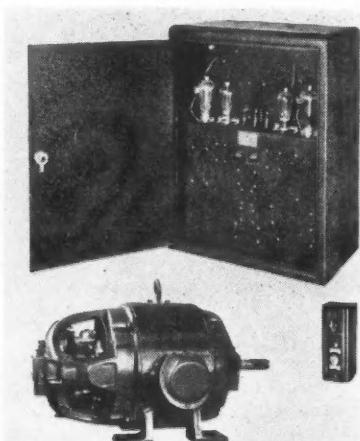


Top—The Ransome Turning Roll Set

The Ransome Turning Roll Set with tank in position

driven rolls controlled through a Reeves variable-speed unit, giving a range of speeds to meet individual job requirements. Remote push button control for forward or reverse rotation is furnished. The center-to-center distance of the rollers can be adjusted for handling work from two feet to fourteen feet in diameter. One or more sets of idler rolls are used, according to the length of the cylinder being welded. Units of various capacities are available for handling loads up to 75 tons.

A NEW electronic adjustable-speed drive, the Mot-O-Trol, is announced by Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It provides close speed regulation over a 20 to 1 speed range for direct current motors operating from an alternating current source. Features of the electronic drive include stepless speed control, automatic close speed regulation over wide load fluctuations.



Electronic control cabinet, push button control station and motor for the Westinghouse Mot-O-Trol.



Official U. S. Navy Photograph

A worker on the "heat-treat front" of a machine-tool plant, quenching a batch of gears for war-production milling machines. Gears have just been Homo-carburized in the furnace behind the man.

Fighting for Better Carburizing? You Can Win by the Homocarb Method!

Many a plant which faced a bottleneck in quality carburizing is now in full war-production stride because the Homocarb Method was adopted. Makers of machine tools, airplane parts and engines, tanks, trucks and guns have found that Homo-carburizing ends all rejects even on parts which are, by previous standards, difficult to treat.

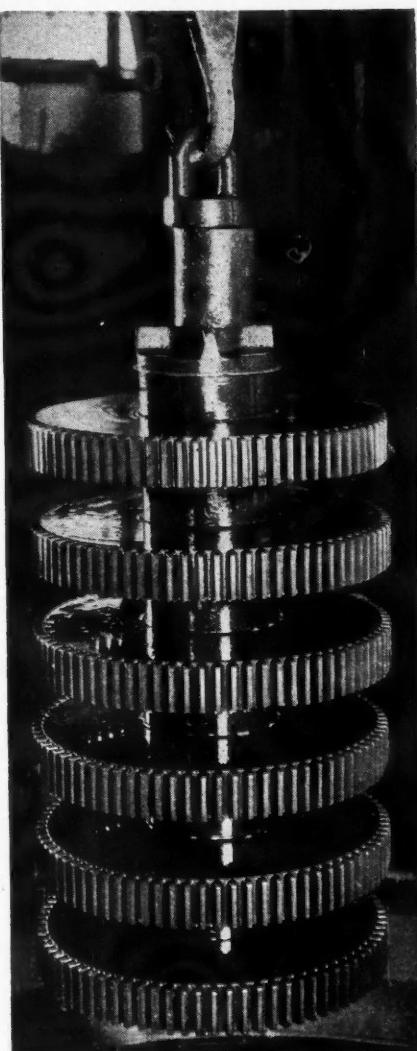
The gears shown here are typical. Made of SAE4615 (nickel-moly) steel, they require a carburized case specified to be between 40 and 50 thousandths of an inch, prior to finish-grinding. A batch of six gears, weighing 480 lb., is carburized at 1675 F., and quenched immediately it leaves the furnace. Its case is uniformly

45 thousandths thick, and retains the full uniformity of texture permitted by the steel stock. When cool, the gears are tempered in a Homo furnace, not shown in the photo. This treatment eliminates any hard spots which might have been present, so that the finish-grinders cut rapidly and smoothly, producing a finish which more than meets the rigid specifications of the machine-tool builder. As far as we have heard, no reject in this plant has ever been charged to either Homo Carburizing or Homo Tempering.

An experienced heat-treater requires only a few hours to master the operation of Homocarb Method equipment. It gives him automatic

control of the four factors which he must consider in the heating cycle; namely, quality of carburizing gas, quantity of gas, temperature of carburizing and time of carburizing. With these factors under his control, the man applies his skill and knowledge to best effect; the work is speeded up and uniform results are maintained.

To receive engineering information on the application of Homocarb or Homo Tempering to a wartime problem, just outline the problem to us. Or, if you prefer, we'll send catalog on request.



Homo-carburized gears, immediately after quenching and before quench oil is removed. Note smooth, scale-free surfaces. These are nickel-moly gears; carburized case is uniformly 45 thousandths thick.

Jrl Ad T-623(14)



LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS • TELEMETERS • AUTOMATIC CONTROLS • HEAT-TREATING FURNACES

full torque at extremely low speeds, smooth stepless acceleration and deceleration, and dynamic braking.

The new drive has four parts. These are the power transformer for separate mounting, the Mot-O-Trol cabinet with the thyratron tubes and the current limiting and speed regulating control, the control station with potentiometer to vary the voltage supplied to the armature and field circuits and with start and stop push buttons, and a shunt wound direct current motor.

The standard Mot-O-Trol is designed to automatically regulate a pre-set motor speed so as to maintain essentially constant speed regardless of load. The

direct current voltage output of the main rectifier tubes is controlled by small tubes to compensate for speed changes. For a speed range of 10 to 1, with torque varying from no load to full load, speed will not vary more than 4 per cent from a present value. Maximum variation for the 20 to 1 speed range is within 8 per cent. No additional rotating part, other than the d-c motor is required. No separate line starters or field rheostats are necessary.

At present, a standard drive is available for ratings up to 1 hp for single-phase operation on 110 or 220 volt, 60-cycle systems. Special drives of larger

horsepower rating can be designed to suit particular application requirements.

A NEW line of ring style holders, designed for curved line marking of all types of parts, from $\frac{1}{4}$ in. to 6 in. in diameter, is being offered by Jas. H. Matthews & Co., Pittsburgh, Pa. These holders are for use in high-speed production stamping equipment, or in hand style units where marking of parts may be limited. In the latter

★ ★ MOTOR TEMPERATURE CONTROL FOR THE ★ ★

ENGINES OF WAR

CIVILIAN AND MILITARY



This will go down in history as the War of the Internal Combustion Engine. An important chapter is the efficiency gained by regulating the operating temperature—from the stratosphere to the desert—from June to January—from secret military motors to the family bus, today measuring gas-mileage with an eye-dropper.

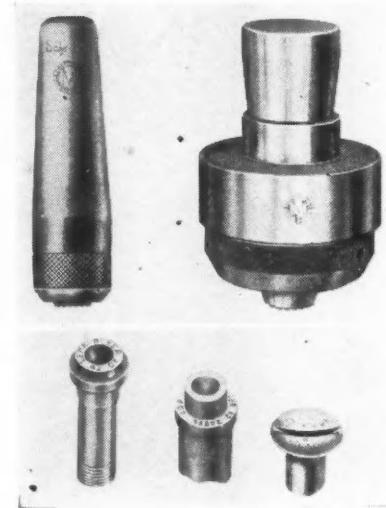
When the Automotive Industry again designs for civilian use Dole Motor Temperature Thermostats fresh from wartime achievements, will again claim leadership in this field.

THE DOLE VALVE COMPANY, 1901-41 Carroll Ave.,
Offices: Philadelphia, Detroit and Los Angeles

DOLE

★ PRIMERS ★ Thermostats ★ FITTINGS ★

Co-operating with the Government and Our Regular Customers

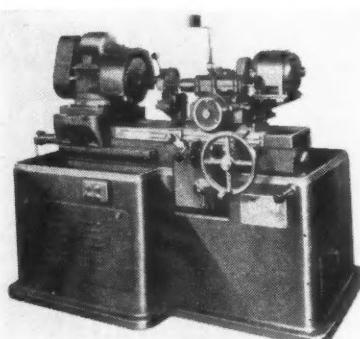


Matthews Ring Style Type Holders and three types of marked parts

case, the "Safe-Hed" feature is provided in the head of the holder. Either segment type, which is engraved with one character only, or logo dies engraved with two or more characters, from $1/32$ in. to $1/2$ in. in size may be used with the new head. Dovetail self-locking type is supplied for positive holding.

These holders are custom built and engineered to fit the individual marking need. They are suitable for marking rounds, dials, bearings, tubing rims and special parts, whether the surface is recessed, concave or convex.

S AV-WAY INDUSTRIES, Detroit, Mich., are offering an internal grinder designed to meet varied grinding conditions. Its special feature is that it provides both hand and hydraulic table



Sav-Way Internal Grinder

*The demands of wartime
aviation insure better
peacetime performance*

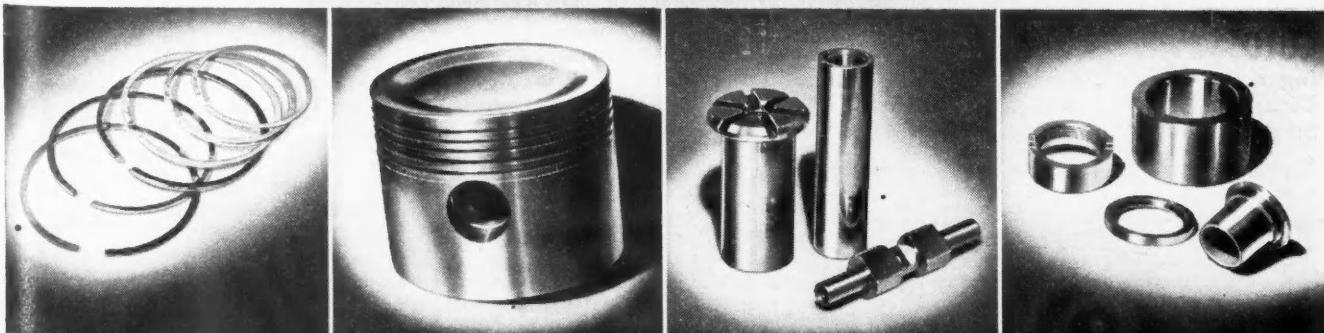
McQUAY-NORRIS ALTINIZED PISTON RINGS

PISTONS..PINS..

HARDENED & GROUND PARTS

War demands new and higher standards of performance and stamina in aviation parts. McQuay-Norris with a third of a century experience in making automotive precision parts is now extending its services to the aviation industry in increasing measure. McQuay-Norris' policy of clinical research is carried out by our Aircraft Division which offers the industry various precision parts, technical assistance and research experience. Your inquiries are invited.

PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



McQUAY-NORRIS MFG. CO. (AIRCRAFT DIVISION), ST. LOUIS, U.S.A.
CANADIAN PLANT, TORONTO, ONTARIO

PARTS FOR AIRCRAFT ENGINES

Piston Rings
Oil Sealing Rings
Supercharger Rings
Carburetor Parts
Machined Aluminum Pistons
Piston Pins
Counterweight Cheek Pins
Machined Magnesium Parts
Cylinder Hold Down Nuts
Hardened and Ground Parts

PARTS FOR PROPELLER ASSEMBLY

Machined Magnesium Parts
Piston Rings

EQUIPMENT FOR MAINTENANCE OF AIRCRAFT

Pistons for Oxygen Compressor
Piston Rings for Oxygen Compressor
Pins for Oxygen Compressor
Pistons for Air Compressor
Pins for Air Compressor
Piston Rings for Air Compressor

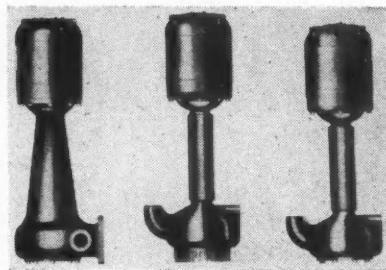
LANDING GEAR PARTS

Machined Aluminum Pistons
Piston Rings
Hardened and Ground Parts

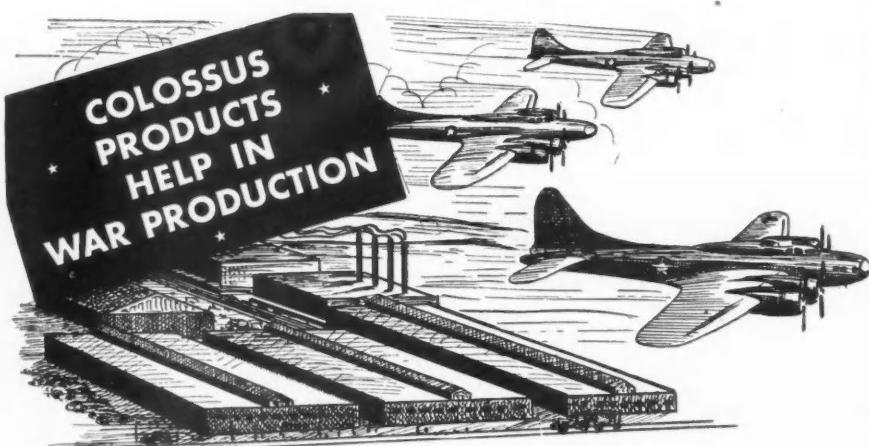
operation. Each of these is wholly independent of the other, though it is possible to use both hand and hydraulic feed in combination on the same job and in the same setting.

Hand operation is said to give the worker complete control for setting up, and to be frequently preferable for short holes, blind holes, and facing. With the hydraulic system, high table speeds by power are obtainable for long holes. These table speeds range up to 55 feet per minute. Minimum table stroke is $\frac{1}{8}$ in., maximum 24 in.

THREE new War Model coolant pumps, each available in 17 stand-



ard sizes, have just been put into production at the Pioneer Pump and Manufacturing Company, Detroit, Mich. Model VBD is said to be the only pump on the market with three



American Industry some time ago converted from civilian to war-time production. Colossus Brand products kept pace with the change and are anxious to work with you on any finishing problems that may come up in your conversion. Rhodes is grateful for the commendations received from war goods producers.

COLOSSUS BRAND*

WHITE SPANISH FELT WHEELS & BOBS are made in a full range of diameters, thicknesses, densities to meet your specific polishing requirements.

COLOSSUS BRAND*

CUT FELT includes innumerable precision die cut Felt parts, such as Gaskets, Washers, Seals, Wicking, etc.

COLOSSUS BRAND*

FELT is available in many qualities, densities, and thicknesses for all industrial uses. Let us show you how Felt can do a better job for you on vibration control, insulation, oil retention, oil transmission, shock absorption, packing, polishing, or many other specialized applications.

OTHER PROVEN

COLOSSUS BRAND* PRODUCTS Rhodes' industrial polishing, abrading and cleaning products include — Aluminide (*Aluminum Oxide*) . . . Dicarbo (*Silicon Carbide*) . . . Rouges . . . Powdered & Lump Pumice . . . Steel Wool . . . Sponges . . . Chamois.

*Colossus Brand stands for four decades of manufacturing, mining and milling experience



JAMES H. RHODES & COMPANY

157 W. Hubbard St., CHICAGO, ILL. • 48-02 Twenty-Ninth St., LONG ISLAND CITY, N.Y.

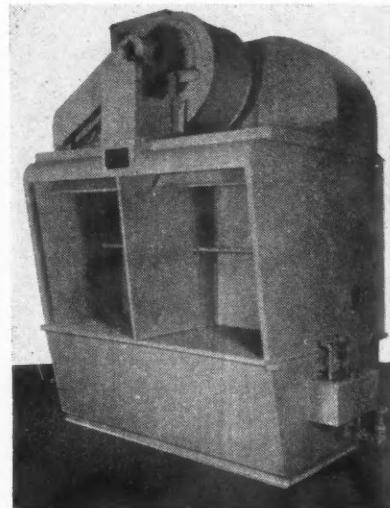
For further information write for our latest catalog.

War model coolant pumps

outlets to permit piping on either right or left side, or back into coolant sump through intake bracket. Model VA is used where submersion in coolant sump is more practical than outside mounting would be. Model VC was designed for external use in cases where a tank cannot be utilized efficiently, mounted with either vertical or horizontal bracket.

ANOTHER unit for processing magnesium has been added to the line of dust collectors being offered by Industrial Equipment Corporation, Detroit, Mich. The new Hydro-Whirl unit is available for use in either booth type or individual collectors for grinding stands. It has only one mechanical moving part; a fan unit.

In operation, dust laden air is drawn



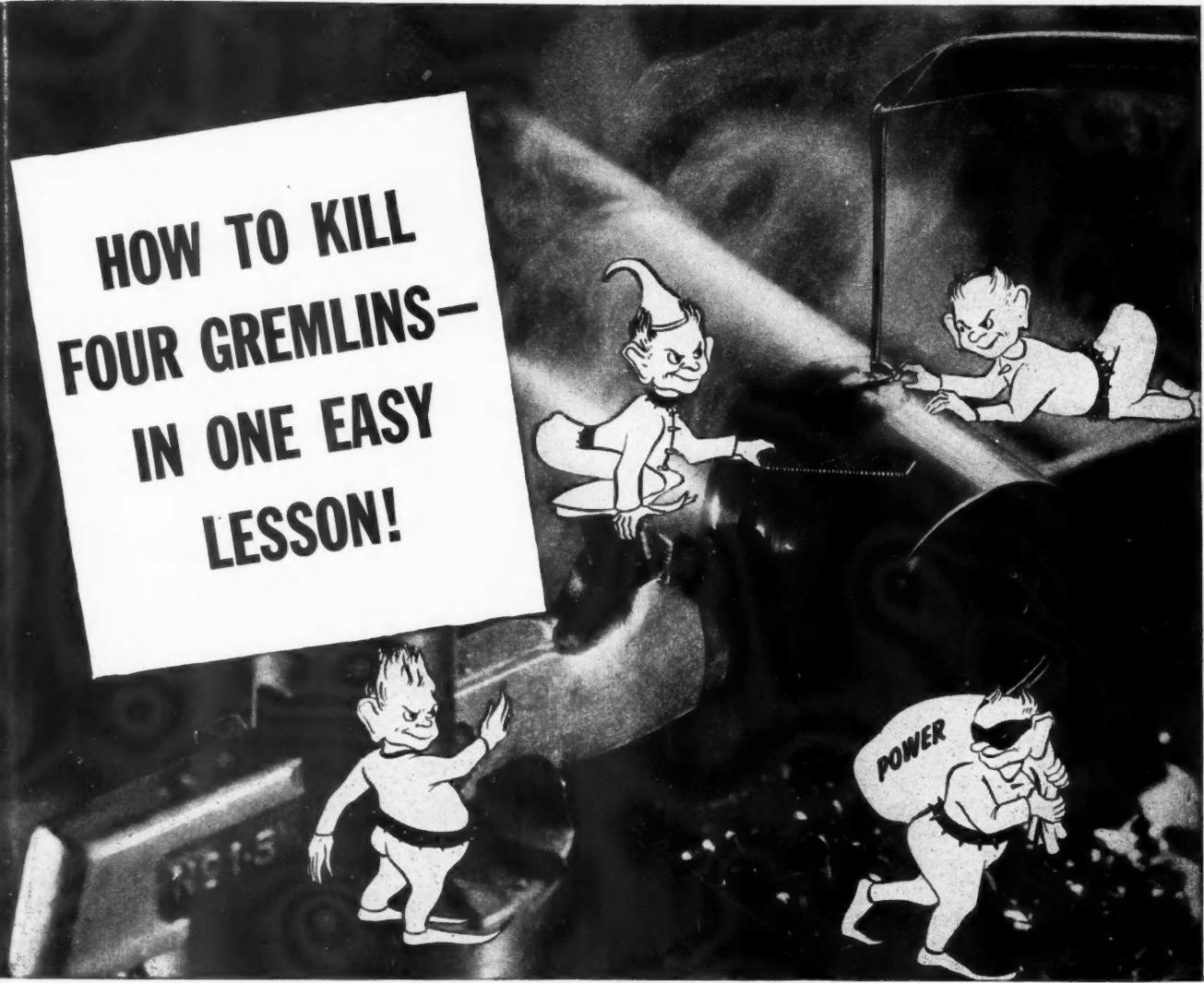
Hydro-Whirl Dust Collector

through an orifice, causing a violent spray of water. Here the dust is "water whirled" out of the air and is knocked down into a tank below, where it forms a sludge which can be easily removed. As the operation of the Hydro-Whirl permits the cleaned air to be returned to the room, less heat is lost making for material savings in heating costs.

FOR resistance welding and other applications, an Electro-Thermostatic Flow Switch which detects the lack of proper cooling water required for adequate cooling of Ignitron Tubes has been developed by Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

The Electro - Thermostatic Flow Switch is designed for use where a liquid is used for cooling and where a smooth positive acting flow switch is required. It consists of a 100-watt transformer having a one-turn secondary short circuited through a piece of high resistance stainless steel tubing through which flows the water from the Igni-

HOW TO KILL FOUR GREMLINS— IN ONE EASY LESSON!



There's a quartet of gremlins with a particular fondness for cutting tools. Their names are Friction, Heat, Power Thief and Tool Wear. Anyone of them can stall production.

There's an easy way to help kill 'em off . . . and to keep them from coming back again.

Simply specify Chillo Cutting Oils. These famous Cities Service coolants deliver speed, fine finish, and longer tool life. They are particularly appropriate now, for they were especially designed to fit the most exacting requirements of wartime production.

Get in touch with your nearest Cities Service office today. A Cities Service lubrication engineer will confer with you on the needs of your particular machining operations. No obligation, of course.

For a free, informative booklet on Metal Machining Fluids write to Room 1386, Sixty Wall Tower, New York, N. Y.



MAUMELLE ORDNANCE WORKS
CITIES SERVICE DEFENSE
CORPORATION

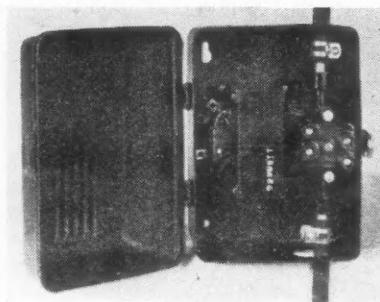
CITIES SERVICE OIL COMPANY
NEW YORK • CHICAGO

ARKANSAS FUEL OIL COMPANY
IN THE SOUTH
SHREVEPORT, LA.

★ ★ OIL IS AMMUNITION — USE IT WISELY ! ★ ★

tron tubes. A normally closed two-pole thermostatic switch is used. It is available in either a 1-½ gallon or 3-1½ gallons per minute size in both a 25 or 50/60 cycle or 220/440 volt rating. Other voltage ratings are available by supplying an autotransformer.

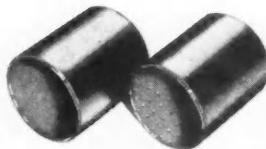
Furnished with a spring mounting to insure against excessive tightening of the switch elements, the Electro-Thermostatic Flow Switch is available with or without enclosing steel cabinet, and all parts are easily accessible for replacements. Mounting space required is approximately 7 in. wide by 9 in. high by 5 in. deep.



Westinghouse Electro-Thermostatic Flow Switch

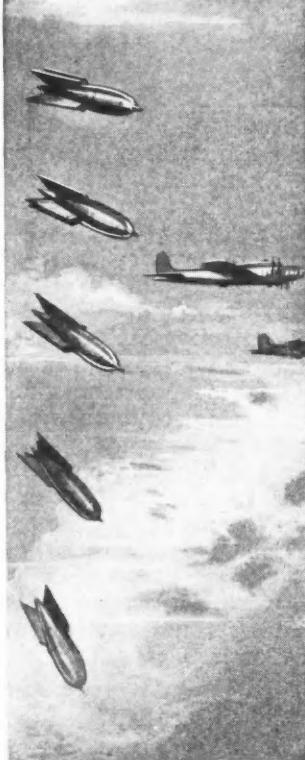


Speeding Destruction



The business of dropping a package of "eggs" on Tojo is easier and more efficient because of sleeve type bearings. The interesting feature of this application is that it employs a bearing material as new as the war.

Johnson Pre-Cast Bearing BRONZE-ON-STEEL was developed to meet peace time applications, but, like many another product, it was easily converted to armament needs. When peace returns, manufacturers will find that Johnson BRONZE-ON-STEEL . . . combining the bearing qualities of BRONZE with the strength of STEEL . . . will give them greater bearing performance in their product. It will be available as finished bearings or in strip form for stampings. It is an ideal metal for washers or other flat pieces. Write for complete information.



**Write for NEW
LITERATURE**

**JOHNSON
SLEEVE BEARING
625 S. MILL STREET**

THE
MOS T
COMPL ETE
SLEEVE
BEARING
SERVICE
in the
WORLD

**BRONZE
HEADQUARTERS
NEW CASTLE, PA.**

THE Wil-Son Manufacturing Corporation, Chicago, Ill., has recently put into production a new "Patent-Flex" heavy duty infra-red drying oven which features maximum flexibility. These heavy duty ovens are made in sections having as many as 16 lamps per row, a total of 112 lamps per section. The sections are adjustable in both height and shape, and may be formed to fit any type of job. The re-

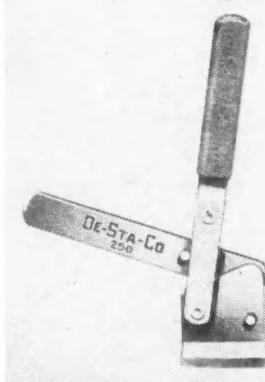


Section of Wil-Son Infra-Red Dry-ing Oven

flector-type lamps used can be cleaned from the back, or replaced while the tunnel is in operation.

A NEW "velvet grip," fitted over the handles of most of the toggle clamps in the De-Sta-Co line of the Detroit Stamping Co., Detroit, Mich., is now being supplied as standard equipment by the manufacturer.

This device, which extends the full length of handle, is said to provide a



**De-Sta-Co Toggle Clamp
equipped with plastic grip.**

positive hand hold, plus cushioned protection for the operator's hands in both locking and releasing, regardless of whether handle is pushed over or "kicked" over.

The new grip is made of heavy extruded plastic. It has the appearance and physical properties of rubber; but unlike rubber, is said not to be affected by oil or grease.